CITY OF RIPON

NOISE ELEMENT

Of the GENERAL PLAN

Adopted September 16, 1975

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SECTION 1

INTRODUCTION

A. GENERAL

This Noise Element presents a general analysis of noise conditions existing and/or influencing the Ripon area. It also delineates policies and methods which may be used to avoid future noise-related land use conflicts, and to alleviate present noise problems. It will be used as a guide for developing and implementing programs to protect the health, safety and welfare of the populace from harmful or disturbing effects of noise. The Noise Element is associated closely with the circulation, land use, and housing elements. It may be used as a guide to review and update all elements in the General Plan to keep the document internally consistent.

B. LEGISLATIVE HISTORY

Attention has recently been focused on noise problems. This has been brought about by a general trend toward increasing environmental awareness. It has also occurred since average noise levels in communities have risen; hearing loss among Americans has been accelerating, and because noise sources have increased phenomenally and spread into what were, until recently, very quiet areas.

The federal and state governments have recognized this problem. The Federal government passed the Noise Control Act of 1972 which authorized the Environmental Protection Agency (EPA) to set noise emission limits for noisy products. The State of California has adopted noise limits governing the sale and use of motorized vehicles. To bring noise impacts into focus in planning for future land use, Noise Elements are required to be included in local General Plans.

The specific authority for preparation of the noise element is California Government Code Section 65302 (g) which states the General Plan shall include:

> "A noise element in quantitative, numerical terms, showing contours of present and projected noise levels associated with all existing and proposed major transportation elements. These include but are not limited to the following:
>
> (1) Highways and freeways
> (2) Ground rapid transit systems
> (3) Ground facilities associated with all airports operating under a permit from the State Department of Aeronautics.

These noise contours may be expressed in any standard acoustical scale which includes both the magnitude to noise and frequency of its occurrence. The recommended scale is sound level A, as measured with A-weighting network of a standard sound level meter, with corrections added for the time duration per event and the total number of events per 24-hour period.

Noise contours shall be shown in minimum increments of five decibels and shall be continued down to 65 dB(A). For regions involving hospitals, rest homes, long-term medical or mental care, or outdoor recreational areas, the contours shall be continued down to 45 dB(A).

Conclusions regarding appropriate site or route selection alternatives of noise impact upon compatible land uses shall be included in the general plan.

The State, local, or private agency responsible for the construction or maintenance of such transportation facilities shall provide to the local agency producing the general plan, a statement of the present and projected noise levels of the facility, and any information that was used in the development of such levels."

C. PREPARATION HISTORY

Preparation of the Noise Element applicable to San Joaquin County was completed by the San Joaquin County Council of Governments (COG) and adopted July 23, 1974. Ripon's Element was prepared in part by extracting from the COG document those portions applicable to the Ripon area. Also, a specific study was made of Ripon noise problem areas. A summary of many of the findings in the COG element will be used in this element. Further information regarding the findings may be obtained from the COG element.

D. DEFINITIONS

Listed below are terms used in this element:

Adjacent: Where peak sound levels from major transportation routes (or industry or commerce) exceed 60 dB(A). As a general guideline this would be approximately:

a) 1000 feet either side of high speed truck routes at grade.
b) 450 feet either side of low speed (25-35 mph) truck routes at grade.
c) 140 feet either side of low speed (25-35 mph) automobile-only routes at grade.
d) 270 feet either side of high speed truck routes depressed 20 feet.
e) 700 feet either side of high speed truck routes elevated 20 feet.
f) 3000 feet either side of a railroad track.

Adversely affect: As defined in League of California Cities Model Noise Ordinance, Training Guide and Enforcement Manual, i.e., no more than 5 dB(A) above the ambient for more than five minutes out of any one hour, up to 10 dB(A) above the ambient 1-5 minutes out of an hour and up to 15 dB(A) above the ambient 0-1 minutes out of an hour, with corrections for disturbing qualities.

Ambient: The background noise level always present when isolated, identifiable sources are absent.

Commercial or industrial areas: Where commercial or industrial uses exist.

Critical noise routes: Roads carrying more than 300 trucks per day on an annual average, or more than 10,000 vehicles per day; rail lines with more than 10 operations per day on an annual average.

Community Noise Equivalent Level: The Community Noise Equivalent Level (CNEL) is a noise rating scale which averages the noise level and duration of all noise events received at a point. Weighting factors are included which place greater importance upon noise events occurring during the evening hours (7-10 p.m.) and even greater importance upon noise events at night (10 p.m. to 7 a.m.). Measured in dB(A), CNELs show noise impact zones.

Decibel: A unit for measuring the relative loudness of sounds detectable by the human ear, abbreviated dB. An "A" suffix indicates a weighting to correspond more closely to how people perceive sound.

Major noise sources: Major roads as defined, railroads with more than 4 operations per day, railroad switchyards, public access airports, public and private industrial and commercial use areas, and commercial heliports.

Major roads: All existing or proposed roads, carrying or designed to carry more than 100 trucks per day or 5,000 vehicles per day.

Noise contour: A line passing through points where the same sound intensity level prevails. Contours form bands of varying width emanating from a noise source.

Other sensitive land uses: hospitals, convalescent hospitals, rest homes, schools, open air ampitheaters, quiet recreation areas.

Problem noise routes: Roads carrying 100-300 trucks per day on an annual average, or 5000-10,000 vehicles per day; railroads with 4-10 operations per day on an annual average.

Residential: Places where people live and sleep. Includes but is not limited to single family dwellings, apartments, institutions, mobilehomes and group quarters, hotels and motels.

Residential area: Where, within a 60 dB(A) contour on either side of a major road there are 13 or more separate detached dwelling structures (including apartments, group quarters, mobilehomes, institutions) in a row within a distance of a quarter of a mile.

Trucks: Includes all trucks with three axles or more, and two axle trucks with four rear wheels. This excludes light pickups and vans.

SECTION II

NOISE ELEMENT GOALS AND POLICIES AND IMPLEMENTATION PROGRAM

A. General Goals

1. To reduce sound levels below the point they become physically harmful.

2. To protect people from noise which interferes with sleep, speech, relaxation, study, or a need for privacy.

3. To alleviate existing noise problems.

4. To prevent creation of new noise problem areas.

B. Residential and Recreational

Goal:

1. To provide acceptable exterior and interior noise environments for residential and other noise sensitive land uses.

Recommendations:

It is the recommendation of the City of Ripon that:

1. New residential and other noise sensitive use structures proposed adjacent to problem or critical noise routes, or commercial or industrial areas be designed so that peak interior noise levels from these sources do not exceed maximum acceptable levels.[1]

2. Noise levels be considered in the design and location of recreational areas.

C. Commercial and Industrial

Goals:

1. To encourage reduction of sound levels in commercial and industrial areas so that sound levels do not interfere with work activities or exceed physically harmful levels, or "adversely affect"[2] more sensitive land uses.

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[1]Levels as defined in Standards Chart on following page.

[2]As defined, page 3.

INTERIOR NOISE LEVEL STANDARDS

	dB(A) Desired Continuous Background Levels	Maximum Acceptable Peak Levels
Residential and Hotels and Motels:		
Interior Living Areas	25-40	55
Interior Sleeping Areas	20-35	40
Hospitals, Convalescent Homes, Rest Homes, Housing for the Elderly:		
Interior Living Areas	25-40	50
Interior Sleeping Areas	20-30	35
School Classrooms, Libraries	35-40	45

DESIRABLE BACKGROUND NOISE LEVELS

Use	Day dB(A)	Night dB(A)
Rural Residential	35	25
Suburban Residential	40	30
Urban Residential	45	35
Commercial	55	45
Industrial	60	50
Hospitals...	35-40	25-30
Schools, Libraries	35-45	

Sources: Kryter, Karl, Effects of Noise on Man
Environmental Protection Agency, Effects of Noise on People
Environmental Protection Agency, Public Health and Welfare Criteria for Noise
Noise Pollution Hearings before the U.S. Senate
Burns, William, Noise and Man
A Report to the 1971 Legislature on the Subject of Noise Pursuant to Assembly Concurrent Resolution 165, 1970, Department of Public Health, State of California, p. 33.

SUGGESTED DESIGN SOUND LEVELS
FOR VARIOUS USES[1]

Type of Use	dB(A) Level
Concert halls, recital halls	21-30
Large Auditoriums, large theaters and churches	20-30
Small Auditoriums, small theaters and churches	not above 42
Large meeting and conference rooms	not above 42
Private or semiprivate offices	38-47
Large offices, reception areas retail shops and stores, cafeterias..	42-52
Lobbies, laboratory work spaces, drafting and engineering rooms...	47-56
Light maintenance shops, office and computer rooms, laundries	52-61
Shops, garages, power plant control rooms...	56-66
Other commercial and industrial areas where speech interference is not a consideration	less than 70

[1]L.L. Beranek, W.E. Blazier, and J.J. Figwer, "Preferred Noise Criterion Curves and their Application to Rooms", Journal of the Acoustical Society of America 50, 1971, pp. 1223-1228.

Recommendations:

It is the recommendation of the City of Ripon that:

1. New commercial or industrial development proposed adjacent to residential or other noise sensitive land uses be designed so that noise sensitive land uses are not "adversely affected".[1]

2. Noisy industrial areas, and heavy industrial or commercial zones be located and designed so as to be permanently buffered from uses which demand quieter noise environments.

3. Industrial areas and zones be located so that truck access is easily available without truck routes having to pass through noise-sensitive land uses.

4. As feasible alternatives can be worked out or become available, existing noise-related land use conflicts be alleviated.

5. Temporary noisy activities, such as but not limited to construction, and city maintenance activities, be limited to daytime hours (7 A.M. to 7 P.M.)

6. City employees wear personal hearing protection when noise levels at work are potentially damaging to hearing.

7. Noise levels be taken into consideration when purchasing new equipment and when building or remodeling municipal structures.

D. Transportation

Goal:

1. To insure that peak noise levels from major transportation routes or facilities do not have harmful or disturbing effects on people in surrounding land uses.[2]

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[1]As defined, Page 3.

[2]Design goal levels from major transportation routes or facilities are exterior peaks of 60dB(A) at the closest part of residential and other sensitive land uses and 70dB(A) peaks in other areas.

Recommendations:

It is the recommendation of the City of Ripon that:

1. Noise impacts on surrounding land uses be considered and feasible measures taken to minimize noise-related land use conflicts when designing or improving major transportation routes.

2. Existing truck routes be reviewed to consider noise impacts on surrounding land uses.

3. New truck routes be located or designed to provide for efficient transportation of goods, and to disturb as few residential or other noise sensitive land uses as possible.

E. Implementation Program

The City of Ripon will:

1. Encourage, through presentations and publications, increased awareness of 1) the effects of noise on people; 2) problem noise situations in Ripon; and 3) possible solutions to those problems.

2. Review its barking dog ordinance to see that it fairly and expediently deals with barking dog nuisances.

3. Consider adoption of a reasonable comprehensive noise ordinance to deal with existing noise conflicts.

4. Continue enforcement of state vehicular muffler noise laws.

5. Actively enforce the sound insulation section of the California Administrative Code.

6. Consider adding a noise impact overlay zone to the zoning ordinance within which specific development standards apply to insure adequate insulation of all sensitive use structures.

7. Participate in efforts to locate suitable areas for noisy recreational activities such as motorcycle riding.

8. Carefully consider noise impacts in the Environmental Impact Review process.

9. Consider noise levels when purchasing new equipment.

SECTION III

SOUND, NOISE AND THE EFFECTS OF NOISE ON PEOPLE

A. INTRODUCTION

This section is intended to explain the nature of sound, how it is measured, and the subjective difference between sound and noise. It also describes the many harmful or disturbing effects noise can have on people. Such effects are what make it important for cities to alleviate existing problem areas and to protect against creation of new noise-related problem areas.

B. TECHNICAL SOUND INFORMATION

Sound is a wavelike vibration transmitted by air. Each sound wave produces a minute pressure compression and expansion upon the air. The loudness of a sound depends upon the pressure the sound waves exert. The more pressure, the louder the sound.

The range of sound pressure the ear hears is tremendously wide. Sound pressure levels are measured in decibels (dB) calculated on a logarithmic basis. Zero dB is the threshold of hearing, and the ear begins to feel pain at about 120 dB. Chart 1 relates decibel levels with specific sources and noise effects.

At low sound pressure levels the ear can detect very small increases in sound pressure. At high levels, a much larger increase in sound energy is necessary for the ear to distinguish the increase.

An average person will perceive a 10 dB increase at any level as a doubling in loudness. Thus 90 dB will sound twice as loud as 80 dB and four times as loud as 70 dB.

Combining two identical sound sources increases the overall sound level by 3 decibels, thus 40 dB + 40 dB = 43 dB. If one source is more than 10 dB above another, the lesser noise adds practically nothing to the overall sound level.

Sound drops off 6 decibels for every doubling of distance from a point source. Thus, a source which is 90 dB at 50 feet will be 84 dB at 100 feet and 78 dB at 200 feet in the absence of barriers. If there are barriers in the way, sound levels will be further reduced, depending on height, length, and type of construction of the barrier.

Frequency determines the pitch of sound. High frequency sounds have short wavelengths, vibrate rapidly and sound high to the ear. Low frequency sounds have long wavelengths, vibrate slowly and sound low to the ear. Most sounds are composed of many frequencies which are weighted by the ear to produce what sounds like one sound level: its pitch.

CHART I

DECIBEL REFERENCE CHART

Sound Source	Decibels	Noise Effects
Jet Plane (100 ft.)	130	
	120	Painfully loud, rapid hearing loss.
Amplified Rock Music	110	
Automatic Punch Press (3 ft.)		
Shout (6 inches)	100	Maddening sound
Jackhammers (50 ft.)		Evidence that noise can interfere with work performance.
Diesel Locomotive (50 ft.)		
Motorcycle (50 ft.)	90	Federal Industrial 8 hour exposure limit
Heavy truck (50 ft.)		Well established that noise levels this high contribute to hearing loss.
Power Lawn Mower (3 ft.)		
10-HP Outboard (50 ft.)	80	Noise very annoying.
Standard Passenger Car (50 ft.)		
Interior of Department Store	70	Noise level for potential hearing loss begins; hard to use phone. Stress reactions become obvious.
Dishwasher, clotheswasher, stove fan (operator's distance)	60	Noise intrudes on normal speech at distances greater than five feet.
	50	Some speech and sleep interference
Average business office		
Living Room (no T.V.)	40	
Bedroom		Sleep undisturbed
Whisper (15 ft.)	30	
		Very quiet
Broadcast Studio	20	
	10	Sound just audible
	0	Hearing limit

Each sound wave is called a cycle. Frequency is expressed in cycles per second, or Hertz (Hz).

The human ear can hear frequencies from about 20 to 20,000 Hz. Most speech is concentrated in the 500-2000 Hz range.

The ear does not hear all frequencies equally well. When modified by what is called an "A" weighting, the decibel scale, abbreviated dB(A) corresponds more closely to how people perceive sound.

Other factors affecting people's reaction to a sound are whether it is steady, fluctuating, or impulsive, and whether it is "broadband" (fan, community background noise), "narrow band" (electric saw), or "pure tone" (tuning fork). Pure tone sounds are composed of only one frequency and are piercing. If a sound has "information content", such as music or speech, it will distract at lower sound levels than most other types of sound.

"Unwanted sound" is noise.

C. HEARING, HEARING LOSS, AND SPEECH INTERFERENCE

1. Hearing. The function of the ear is to convert sound energy into nerve impulses. As sound waves enter through the outer ear and eardrum, the middle ear muscles contract or expand to increase or diminish sounds entering the delicate inner ear. However, this middle ear reflex is imperfect since it cannot adequately protect the inner ear against very loud, impulsive, or sustained noises.

When sounds are too intense and prolonged, the hearing receptor cells, or "hair cells" can be damaged. The inner ear (cochlea) is a coiled tube about 34 millimeters long, containing about 17,000 hair cells.

2. Hearing loss. Hearing loss can occur along parts or all of the cochlea. Thus, the degree of hearing loss depends not only on the severity of injury at any one location, but upon the spread of hearing loss in the inner ear.

Hearing loss usually occurs above speaking ranges and spreads downward. Damage can therefore be substantial before hearing loss is noticed.

Most scientists believe noise levels of 70 dB(A) or more contribute to loss of hearing over a lifetime. Clear evidence is available that noises above 80 dB(A) can contribute to inner ear damage and eventually hearing loss if they are frequently and regularly encountered. Trucks, trains, sport cars, and motorcycles all exceed 80 dB(A) at 50 feet. Amplified music at close range may reach 120 dB(A). In industry, excessively loud machinery is often the norm.

The number of such loud noise sources has grown phenomenally in the last 20 years. Numbers of trucks and cars have more than doubled, commercial jets increased from 0 in 1955 to nearly 2000 in 1970. Appliances, recreational vehicles, power lawn mowers, all contribute to a noisier environment.

Between 9 and 11 million people in the United States are presently estimated to have some degree of hearing loss, and the rate of hearing loss is increasing in part due to increased societal noise levels.

Even where daily exposure to community noises may not pose a distinct hazard in itself to hearing, it may increase individual hearing loss by making it impossible for a worker in a noisy factory to find enough off-job quiet to allow the ears to recover each evening.

Hearing loss can be eliminated if exposure to noise is held to sufficiently low levels, held to sufficiently short durations, and allowed to occur only rarely. But regulation of a person's total exposure to noise is impossible to achieve. Reducing noise levels of the noise source is a better approach. Clearly, quieting all noise sources to 70 dB(A) or less is impossible at present. On the other hand, allowing loud noise sources to continue to proliferate without bound would lead to far greater problems in terms of hearing loss and other adverse effects of noise. As a goal from a hearing conservation standpoint, it is desirable to have as few noise sources as possible which expose people to sound levels in excess of 70 dB(A).

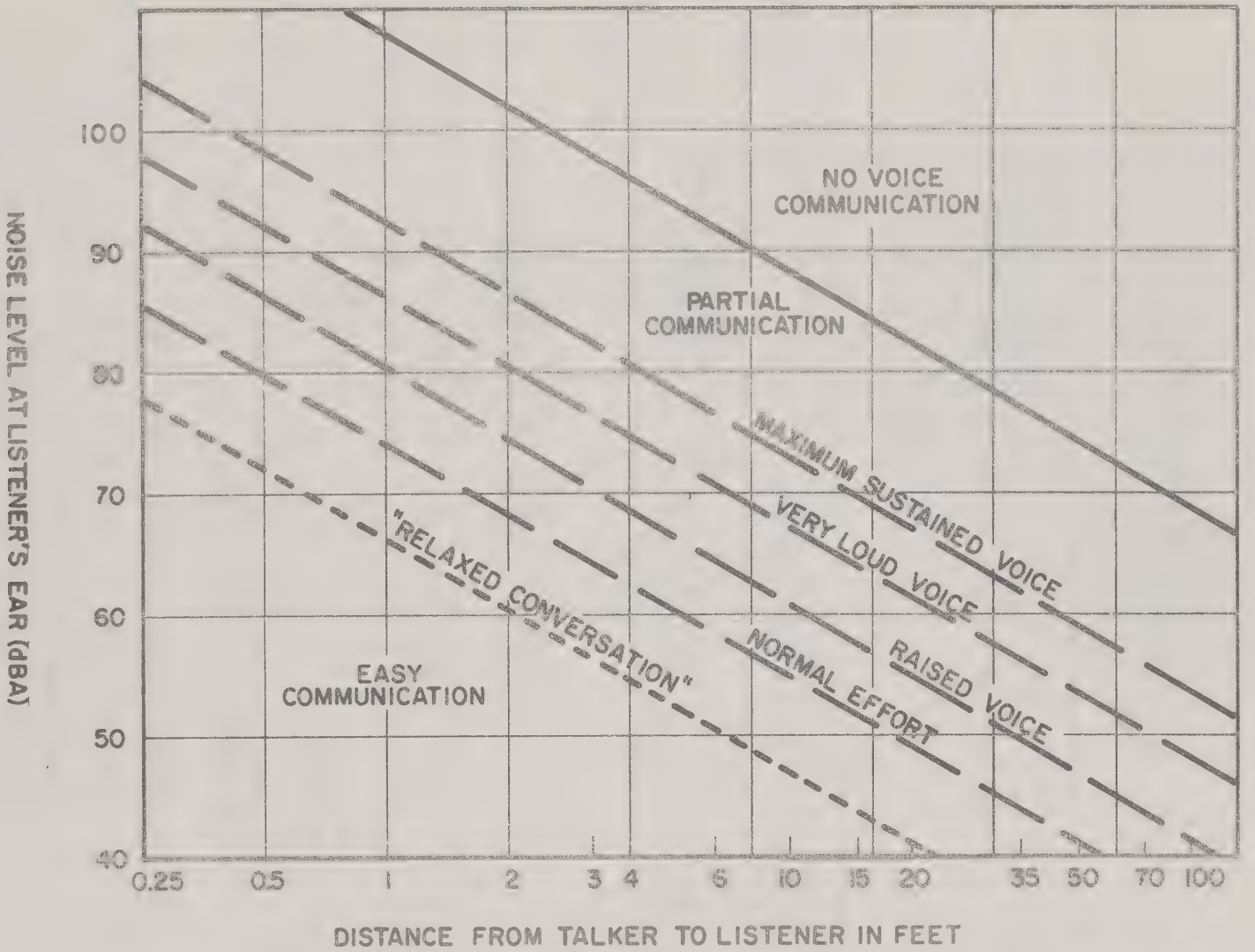
3. Speech interference. Another direct effect of noise is masking, where unwanted sounds interfere with wanted signals, such as speech. Speech interference begins occurring at about 40-45 dB(A) and becomes severe at 60 dB(A) and above. In a highly intellectual, technical society, speech communication plays an important role. Excessive background noise can reduce the amount and quality of verbal exchange and adversely affect education, family life styles, occupational efficiency and the quality of relaxation.

D. NON-AUDITORY EFFECTS OF NOISE ON PEOPLE AND ANNOYANCE RESPONSE

Non-auditory effects of noise on people include sleep interference, physical reactions, adverse effects on human performance and learning, loss of privacy, anxiety and psychological disorders, and annoyance.

1. Sleep interference. To protect a person from sleep interference, sound levels should not rise above 35-40 dB(A). Whether a person is actually awakened by a particular noise will depend on noise levels, characteristics of the noise, stage of sleep, the person's motivation to awaken, age, sex, and so on. Elderly people, and persons who are ill are particularly susceptible to sleep interference caused by noise.

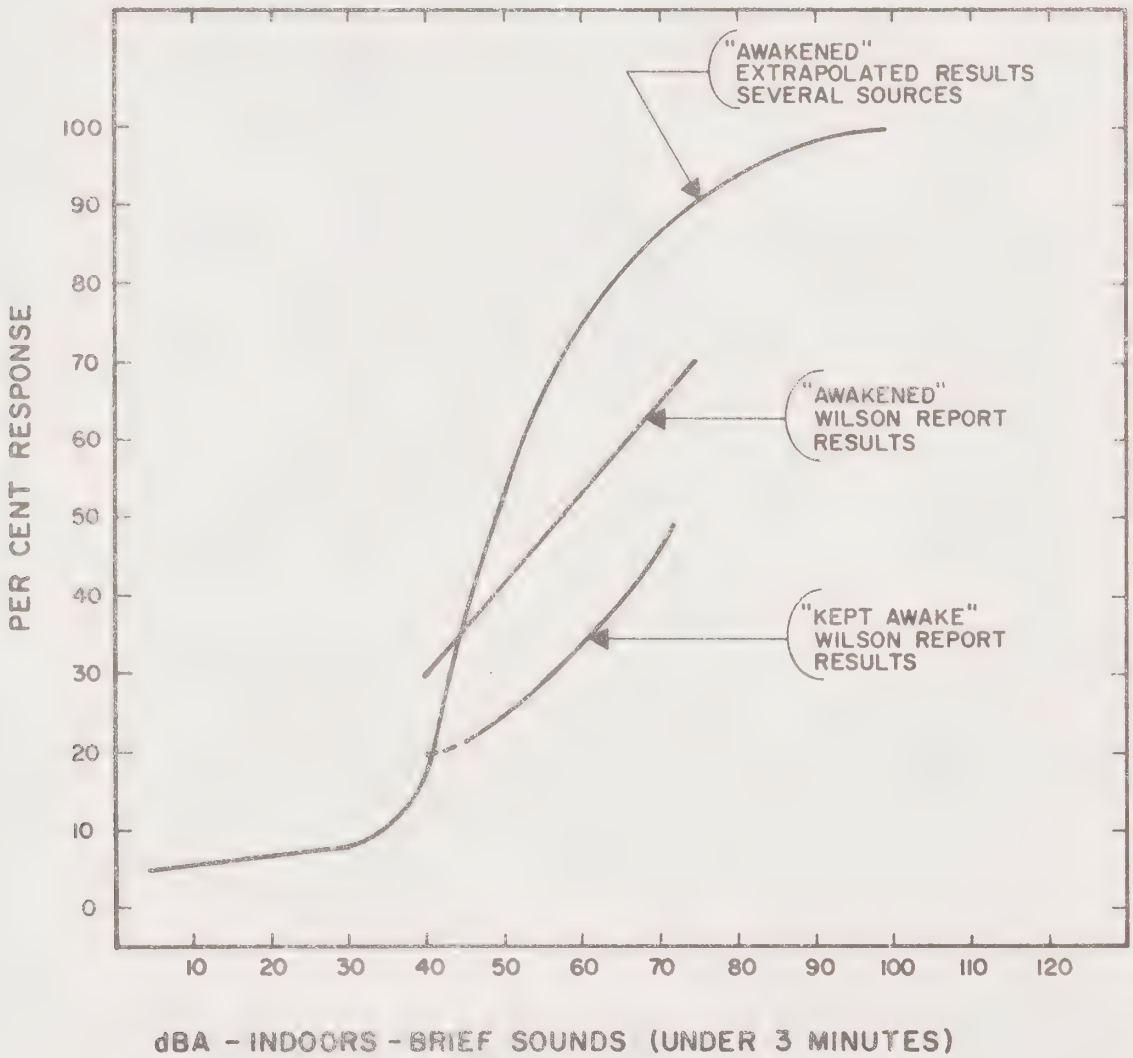
SPEECH INTERFERENCE



Distance at which ordinary speech can be understood outside. Indoors, levels may need to be lower because of the build-up of sound by reflections from walls of a room.

Source: Public Health & Welfare Criteria for Noise
U.S. Environmental Protection Agency, 1973

SLEEP INTERFERENCE



Source: Effects of Noise on People
U.S. Environmental Protection Agency, 1971

2. Physical reactions. Temporary physical reactions to passing noises include:

(at most levels)
- an orientation reflex;
- a startle reflex;

(at about 70 dB(A) and above)
- constriction of the peripheral blood vessels;
- acceleration or deceleration of the heart rate;
- dilation of pupils of the eye;
- changes in breathing patterns;
- changes in movement of the gastrointestinal tract;
- changes in secretion of saliva and gastric juices;
- chemical changes in the blood and urine;

(at higher levels)
- loss in visual acuity;
- disturbance of equilibrium.

It is proposed, and evidence exists, that chronic arousal of such physical responses could aggravate the incidence of medical problems such as headaches, fatigue, digestive disorders, heart disease, blood circulatory disorders, and equilibrium disorders.

It is also proposed that noise as a source of stress is a likely contributor to what many medical authorities believe are stress-related diseases such as ulcers, high blood pressure, heart disease and arthritis.

As a source of stress, noise may also be a contributing factor in mental illness, anxiety, and psychological distress.

3. Performance and learning. Work performance can be adversely affected by noise through distraction and through the physical reactions previously described. While noise does not seem to have an effect on over-all work productivity, it can reduce accuracy of work, particularly of complex tasks, and inhibit learning. Even if it does not do this, the price may be increased fatigue, distraction, and irritability on the part of the employee or student. Studies conducted in Europe recommend 45 dB(A) as an upper limit for peak interfering noise in classrooms.

4. Privacy. As a result of a lack of acoustical privacy, people may experience annoyance, sleep interference, speech interference and all other detrimental effects of noise. Nearly everyone has experienced this effect at one time or another in apartments, hotels or motels. In multi-unit structures, careful attention to building materials and construction techniques at separating walls and floor-ceilings is necessary to provide acceptable interior living environments.

5. Psychological. Facts clearly support the contention that noise can be a source of psychological distress through annoyance, speech and sleep interference, etc. This distress in turn can lead to instability, sexual impotency, headaches, nausea, general anxiety, and changes in general mood.

6. Annoyance. A large number of factors govern how annoyed people will be by noise. First, there are characteristics of the noise itself, i.e., its loudness and duration, whether it is impulsive or steady, contains speech or music, or piercing "pure tones". Second, background noise levels help in determining how "intrusive" and thus annoying a particular noise is. Third, place, time of day and seasonal variations can make a difference; people are more likely to be disturbed at home, at night, and during warm weather. Finally, a person's actual total exposure to the noise source, and his or her attitude toward it may play a part.

The number of people disturbed by noise generally goes up as noise levels increase. Predicting annoyance response to noise in particular situations, however, is difficult. Individuals who complain are generally not unusually sensitive to noise. They do tend to have a higher socioeconomic status and a better education than those who do not complain, but there are few other guidelines. Community-wide annoyance response also depends on leadership within that community and a sense of community. Complaints are not, then, very good criteria to apply in setting protective noise standards. As a result, criteria based on the harmful and disturbing effects of noise on persons have emerged as more objective, measurable, and protective approaches to the problem of setting noise standards.

SECTION IV

NOISE IN RIPON

One of the basic purposes of the Noise Element is to identify existing noise problem areas and high noise sources. A brief discussion of the background noise levels in Ripon and typical noise sources are a general introduction. Specific noise problems are next discussed.

Major transportation routes and facilities are identified. Other noise-generating (industrial, commercial) and noise-sensitive (residential, schools, libraries, hospitals, rest homes, parks...) land uses are also mapped, for it is at the juncture of such uses that potential noise-related land use conflicts exist. Finally, problem areas identified by community surveys or by a COG newspaper noise questionnaire are discussed.

A. BACKGROUND NOISE

Background noise levels outdoors in residential areas in Ripon are relatively high compared to other cities in the county. Levels when measured ranged from 44-54 dB(A) during the day and 40-45 dB(A) at night. This is due to the proximity of Highway 99. Large volumes of traffic on that road produce a steady background noise audible throughout the city.

In Ripon's commercial and industrial areas, background levels are even higher, due primarily to commercially-generated traffic, and industrial blowers, fans and heavy equipment. The daytime background level on Main Street was measured at 55 dB(A) and on Industrial Avenue, 63 dB(A). These are fairly typical levels for such land use areas.

Residential background noise levels in Ripon are at least twice as loud as those in rural areas in San Joaquin County. In some neighborhoods, background noise levels, not peak levels, are high enough to be causing speech interference outdoors.

Background levels are important since the "bothersomness" of specific noise sources are typically related to background noise levels. A 42 dB(A) noise might pass unnoticed in Ripon but sound twice as loud as the background level in a rural setting.

The California Advisory Committee on Noise found few noise complaints will occur when the intruding noise from a specific noise source is 0-5 dB(A) above background levels. When the difference rises to 10-15 dB(A), however, many complaints will usually occur.

From surveys of people's reactions to noise, most people want ambient, or background noise levels no higher than those shown in the table below, although they will accept higher levels without undue complaint.

Location	Noise Level dB(A) Day	Night
Suburban Residential	40	30
Urban Residential	45	35
Commercial	55	45
Industrial	60	50

B. TYPICAL NOISE SOURCES

Superimposed upon steady community background levels are intermittent identifiable noise sources. Some typical sources of noise found in San Joaquin County are listed in the following table. Typical noise levels of various sources also follow.

TYPICAL SOURCES OF NOISE WHICH CAN BE FOUND IN SAN JOAQUIN COUNTY

A. Transportation

1) Trucks

a. Exhaust noise
b. Engines
c. Transmission and differential noise
d. Chain drive noise
e. Chassis noise
f. Brakes
g. Air compressors
h. Sheet metal parts
i. Tire whine

2) Automobiles

a. High speed tire squeal
b. Tire tread noise
c. Rattles
d. Engine noise
e. Exhaust, particularly if the muffler is modified
f. Horns

3) Motorcycles

a. Exhaust
b. Intake
c. Engine
d. Tires

4) Rail

a. Train track noise
b. Breaking
c. Squeak of wheels on curves
d. Whistles
e. Air brakes

5) Aircraft

a. Piston engines
b. Jet Aircraft noise
c. Helicopter blade noise

B. Industrial Noise

1) Out-of-doors processing

a. Air intake
b. Discharge ducts
c. Compressors
d. Engine intakes and exhausts

e. Pump and engine radiation
f. Steam discharge

2. Enclosed Industrial Plant

a. All of above
(1) With open windows
b. Fans and blowers
c. Punch presser
d. Machine tools
e. Forging equipment
f. Printing presses

3. Out-of-doors operations

a. Warehousing of steel and lumber
b. Scrap yards
c. Truck and rail freight handling
(1) hydraulic lifts
d. Transportation and loading
(1) freight cars
(2) local yard movements

4. Plant auto traffic

a. Shift employees
(1) leaving and arriving at early or late hours

C. Construction Noise

1. Diesel engines

a. Generators
b. Compressors
c. Trucks
d. Shovels
e. Bulldozers
f. Frontloaders
g. Scrapers
h. Power shovels
i. Rock drills

2. Electric Motors

a. Whining and groaning sounds

3. Air Compressors

a. Intake and discharge

4. Blasting

5. Pile driving

    a. Engine
    b. Hammer driven caissons

6. Riveting

    a. Hammer
    b. Electric or pneumatic nut-setter

7. Materials handling equipment

    a. Demolition
    b. Scrap material handling
    c. Elevators
    d. Cement mixers

8. Special equipment

    a. Generators
    b. Rock drills

9. Interior finishing

    a. Residential construction
    b. Hammers
    c. Power saws
    d. Electric drills

D. Heating, Ventilating and Air-Conditioning

1. Air Conditioning

    a. Cooling tower
        (1) Fans
        (2) Water spray
    b. Window units
        (1) Compressor
        (2) Fan
        (3) Rattles
    c. Intakes and discharges
    d. Draft fans
    e. Oil burners
    f. Combustion
    g. Pumps
    h. Attic ventilating fans

E. Environmental Noise

1. Leisure activities

    a. Radios
    b. Stereos
    c. T.V.
    d. Musical instruments
    e. Workshop and home improvement tools

2. Outdoor activities

    a. Power mowers
    b. Hedge trimmers
    c. Chain saws
    d. Auto, motorcycle, and motorboat repairs
        (1) Engine run-up

3. Home appliances

4. Talking

    a. On street
    b. Arguments
    c. Parties

5. Vehicles

    a. Ice cream trucks
    b. Delivery trucks
    c. Ambulances
    d. Fire vehicles
    e. Police vehicles
    f. Motorcycles
    g. Motorboats

6. Refuse collection

    a. Trash cans
    b. Engine exhaust
    c. Loaders and compactors

7. Meeting noises

    a. Street meetings
    b. Religious meetings
    c. Concerts
    d. Church bells

8. Children at play

    a. School yard
    b. Playground
    c. Street
    d. Yards

9. Animals

    a. Barking dogs

10. Sound trucks

TYPICAL NOISE LEVELS FROM VARIOUS SOURCES IN dBA

Transportation & Recreational Vehicles	dBA Level
Passenger cars (50')	64-76
Sports Cars (50')	70-80
Light trucks (50')	70-85
Medium-heavy trucks (50')	75-95
Motorcycles-street (50')	65-95
Off Road Motorcycles(50')	80-105
Buses (50')	70-87
General aviation propeller aircraft (take-off @ 1000')	76-93
2-3 engine jet aircraft (take-off @ 1000')	90-100
4 engine jet aircraft (take-off @1000')	100-105
Light helicopter (500')	65-78
Medium - Heavy helicopters (500')	76-92
Diesel locomotive (50')	88-98
Freight cars (50')	80-94
Train horn (50')	90-114
Industrial Machinery, Equipment (User Distance)	
Pneumatic Power Tools (Grinders,Chippers)	90-116
Molding machines	102-106
Air blown devices (for paint, clean, etc.)	90-105
Blowers (forced, fan, induced, etc.)	80-100
Air compressors	92-100
Metal forming (Punch,Shearing)	82-97
Combustion (Furnaces, flare stacks @ 25')	82-97
Turbo generators (Steam @ 10')	88-92
Pumps (Water,hydraulic)	80-92
Transformers	83-84
Industrial	
Tractors (50')	75-95
Graders (50')	80-95
Pavers (50')	85-87
Concrete Mixers (50')	75-88
Movable Cranes (50')	75-85
Generators (50')	72-82
Jack Hammers & Rock drills (50')	80-98
Impact Pile drivers (peaks)(50')	95-105
Vibrator (50')	69-81
Saws (50')	72-82

Home Appliances	Level of Operator Exposure (dBA)
Group I: Quiet Major Equipment and Appliances	
Refrigerator	40
Freezer	41
Electric Heater	44
Humidifier	50
Floor Fan	51
Dehumidifier	52
Window Fan	54
Clothes Dryer	55
Air Conditioner	55
Group II: Quiet Equipment and Small Appliances	
Hair Clipper	60
Clothes Washer	60
Stove Hood Exhaust Fan	61
Electric Toothbrush	62
Water Closet	62
Dishwasher	64
Electric Can Opener	64
Food Mixer	65
Hair Dryer	66
Faucet	66
Vacuum Cleaner	67
Electric Knife	68
Group III: Noisy Small Appliances	
Electric Knife Sharpener	70
Sewing Machine	70
Oral Lavage	72
Food Blender	73
Electric Shaver	75
Electric Lawn Mower	75
Food Disposal (Grinder)	76
Group IV: Noisy Electric Tools	
Electric Edger and Trimmer	81
Hedge Clippers	84
Home Shop Tools	85

C. NOISE SOURCES AND PROBLEMS IN RIPON

1. Transportation Related

In Ripon, as in the rest of the county, transportation noise is the source which affects the most people. 60% of persons returning a COG noise survey questionnaire cited traffic noise as bothering them, 16% cited trains, and 3% cited planes.

Effects of transportation noise can be expected to be worst along high volume transportation routes. A map showing "problem" and "critical" noise routes and facilities follows.

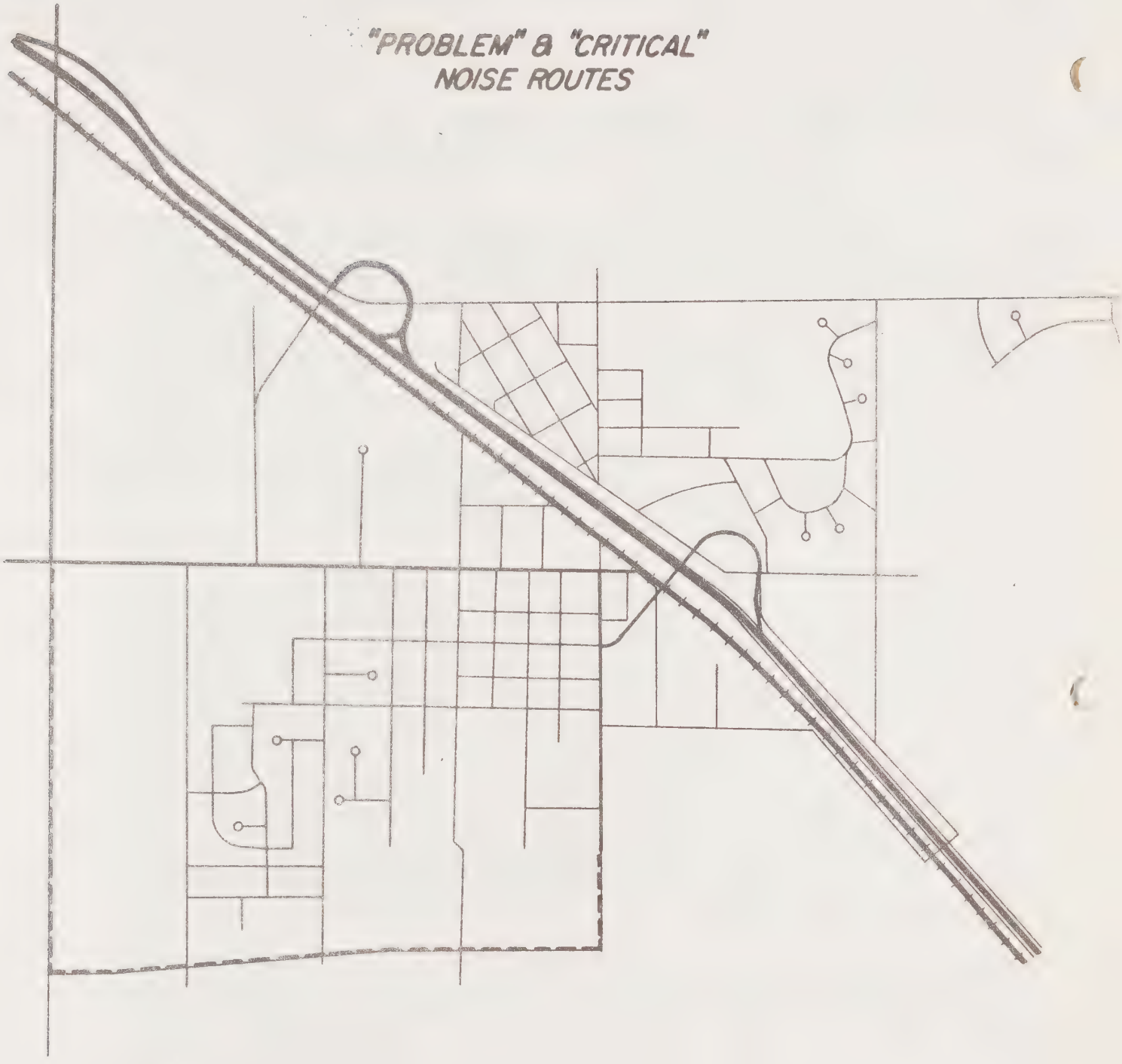
a. Roads: "Problem" noise roads are those carrying 5000-10,000 vehicles per day or 100-300 trucks per day on an annual average. "Critical" noise routes are those carrying more than 300 trucks or 10,000 vehicles per day on an annual average.

Presently about 60 persons in Ripon live in homes bordering on "problem" noise routes. Persons living along one of these, Main Street, can expect speech interference in yard areas 30-50 feet from the nearest lane of traffic up to 6 hours per day. Levels over 70 dB(A) occur up to 1-1/2 hours a day. Every time a truck passes, persons in those yard areas will experience a remarkable number of physical changes. Blood pressure will rise and the heart rhythm change. Pupils of the eyes will dilate. The blood cholesterol level rises. Even the stomach will change its rate of acid secretion. Continual subjection to such levels may exact a toll on physical and mental health. Inside, even with windows closed, residents will experience speech interference from trucks and sleep interference from both cars and trucks. This problem worsens if bedrooms are located at the front of the house facing the street.

Residential and other sensitive uses are not good choices near problem noise routes, especially since traffic and truck volumes have a tendency to increase: what is marginally a problem now may worsen.

If residences are built adjacent to such routes, noise considerations should enter into the design, setback and orientation of residential structures so that interior noise levels are acceptable. The City could make it a policy to have a subdivider provide barriers and back-up lots along such routes. Air conditioning in residences, and placing bedrooms away and garages toward the noise source would also help. Careful attention to construction details so that windows and doors fit tightly, and no cracks exist for sound to leak through is most important to insure that the house achieves its full insulation potential.

"PROBLEM" & "CRITICAL" NOISE ROUTES



CITY OF RIPON
No Scale

CRITICAL ROUTES
PROBLEM ROUTES
PROJECTED PROBLEM ROUTES

Another 110 persons in Ripon live in residences bordering on one of the "critical" noise roads, Highway 99. Over 25,000 vehicles (3200 of which are heavy trucks) pass by their ha[illegible] every day.

Sound levels in these yard areas may exceed 80 dB(A). Speech interference both inside and outside will occur most of the time and sleep interference will be frequent. Noise levels may even be high enough and occur often enough to contribute to long-term hearing loss. Such a road is not compatible with residential use and wherever possible, residential zones should be located away from the freeway with buffer zones in between. Any new residential development adjacent to such a road should only be permitted when sound insulation of interiors is adequate, i.e., peak levels from the roadway do not exceed 55 dB(A) in living areas and 40 dB(A) in sleeping areas. Yard areas should also be buffered so that outside noise levels are significantly reduced. The City could require barriers and/or sound insulation of structures to insure such levels are met. Other sensitive land uses such as schools, hospitals, etc., should also not locate near 99.

In addition to requiring stricter standards for new residential construction near 99, the City of Ripon could request State-built noise barriers along 99 where it passes through existing residential areas. This would not only help persons living near the freeway, it would reduce background levels throughout most of the city.

Appendix A provides a method for predicting actual peak noise levels from these major roads and railroads. Community Noise Equivalent Level (CNEL) noise contours around the freeway and railroad required by State law are also shown.

b. Railroads: "Critical" rail lines are those with more than 10 operations per day. Southern Pacific through Ripon has about 20 operations per day during the winter and 40 or more per day during the summer months. Railroads are intermittent noise sources. Speech interference from trains are annoying, but the more disturbing consequence of train noise is sleep disruption. Adjacent to railroad tracks, noise levels are high and duration of the passing event is so long that sleep interference is very likely to occur every time a train passes. Since there are likely to be ten or more train operations per night in Ripon, sleep interference can be severe, and new residential or other sensitive land use development near the tracks should only be allowed if sleeping areas in particular are insulated to acceptable levels. This is important. Many people can psychologically adapt to excessive noise, but physically they cannot.

Ripon does have a small train switching area, but it is located in an industrial area which mitigates its adverse noise effects.

c. Airplanes and jets: Training flights from the Stockton Airport have created sporadic noise problems in Ripon, as they circle repeatedly at low altitudes. These planes should not be flying over the city. Training flight paths are to the north and east of the city. Any training jets flying low over Ripon are off their scheduled path. Complaints made to the Stockton Airport tower when this occurs should immediately correct any problem. (See map of flight path.)

Long range plans for major transportation routes and facilities in the Ripon area should be worked out between all responsible agencies so that compatible land uses are insured. Improvements in existing major routes should also carefully consider noise factors. Where there are existing noise problems, measures to reduce sound levels, such as barriers, should be considered in the improvement design. Alternate routes or locations could also be considered.

2. Commerce and Industry Related

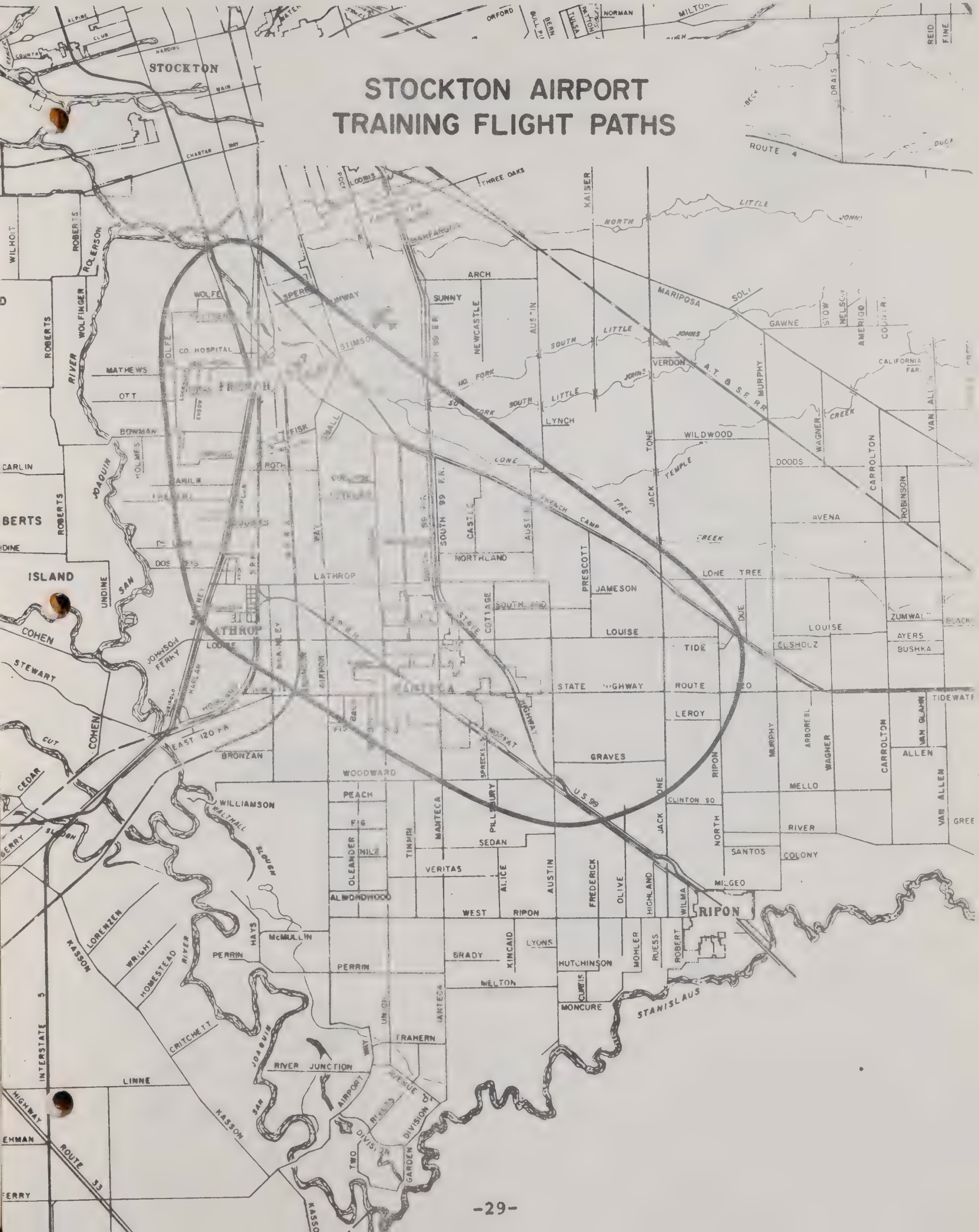
The noise element maps identify the location of noise sensitive and noise generating land uses.

About 14 homes are presently located in areas where noise from industrial activities may create an undesirable living situation. The City has been careful to separate incompatible uses where possible. Continued land separation of residential from industrial or noisy commercial areas will avoid creation of potential noise-related land use conflicts in most cases. However, in those areas where residential zones are adjacent to industrial or commercial areas, performance standards to control noise would be advisable, as would residential insulation standards.

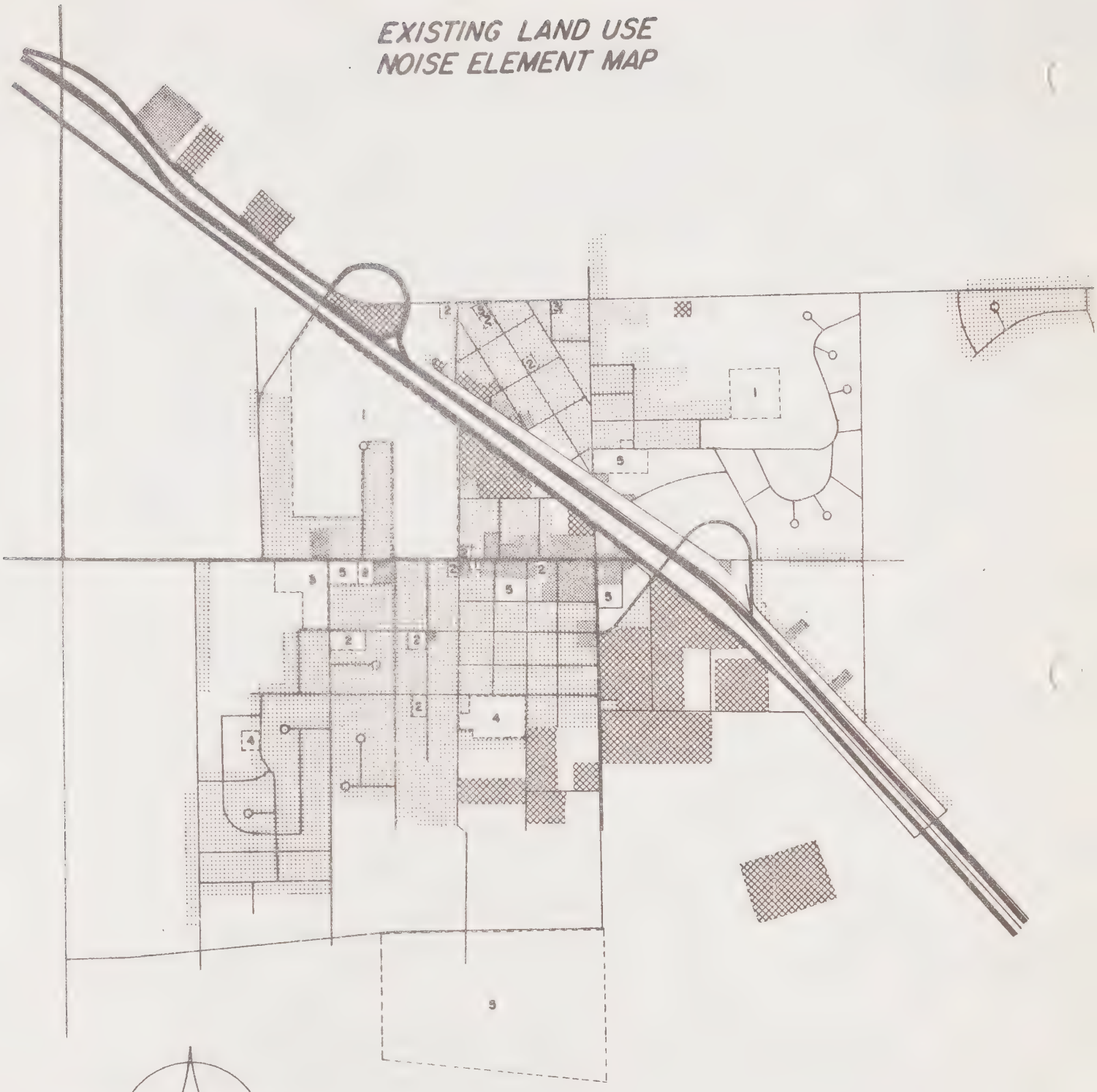
Whether a new industry or commercial enterprise is locating near existing residences, or vice versa, noise considerations should include:

1) Business hours and number of persons employed: Are there or will there be 24-hour operations which mean shift changes and large numbers of cars starting up late at night? What roads will they use? Does the establishment stay open late? When are the busiest hours of operation?
2) Maintenance activities: At what time and what kind of plant or office maintenance activities occur or will occur? (Daily garbage pickups or noisy parking lot sweeping may occur in the very early morning hours.)

STOCKTON AIRPORT
TRAINING FLIGHT PATHS



EXISTING LAND USE
NOISE ELEMENT MAP



CITY OF RIPON

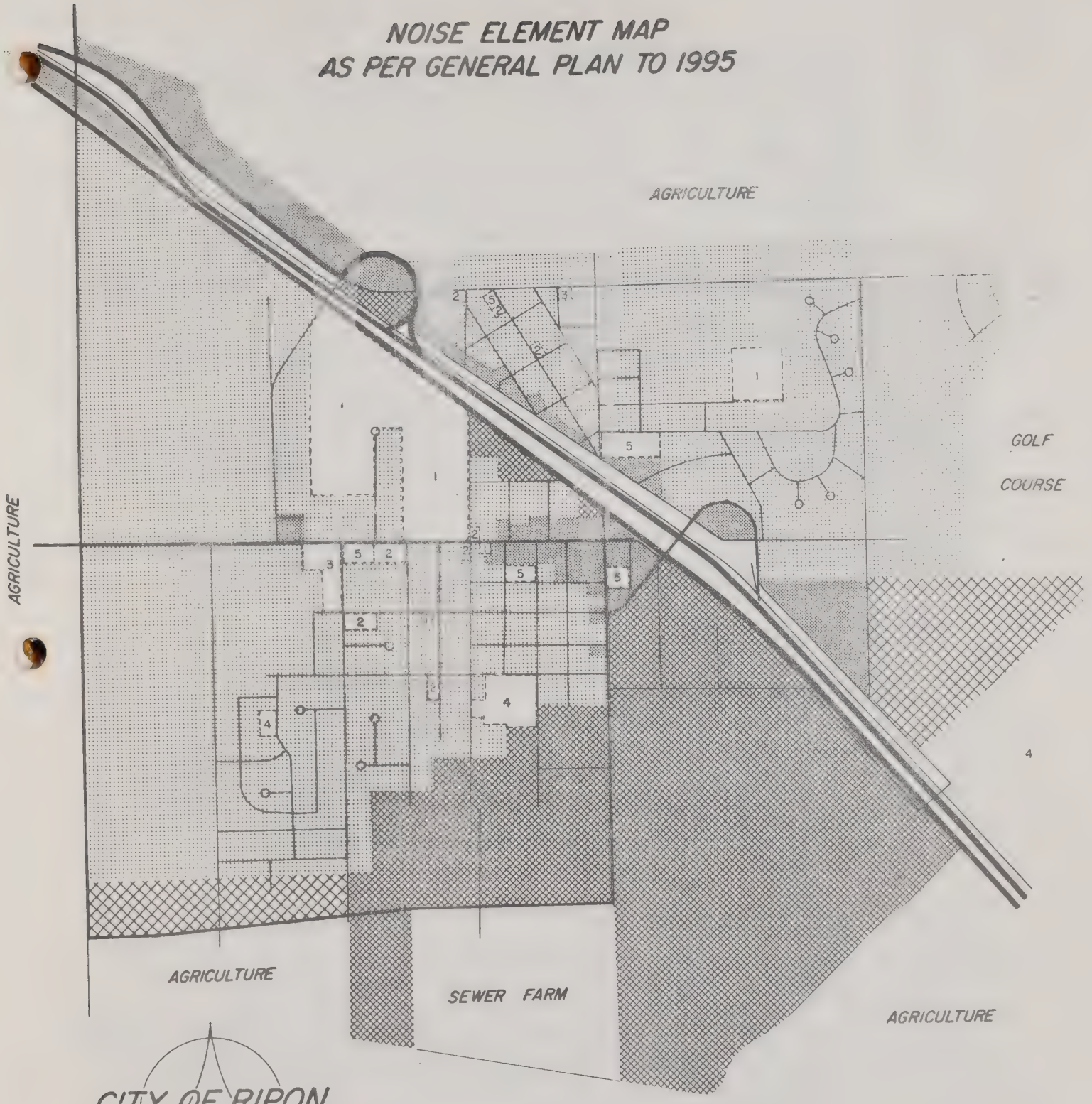
No Scale

RESIDENTIAL
COMMERCIAL
INDUSTRIAL

1 SCHOOLS & LIBRARY
2 CHURCHES
3 HOSPITALS, REST HOMES, HOUSING FOR ELDERLY
4 PARKS
5 OTHER

DATE 1-75

NOISE ELEMENT MAP
AS PER GENERAL PLAN TO 1995



3) Deliveries and pickups:
Do or will trucks need to make deliveries or pickups? At what time and how often do or will they come? On what roads do or will the trucks travel?

4) Machinery:
What machinery on the premises may be bothersome to nearby residents, and what are the noise levels of these machines? Do they contain piercing tones? How often and at what time of day do or will they run? Do or will fans or other steady noises provide a higher than desirable background noise level for a residential area?

5) Plant or office expansion plans.

6) Sound Level Measurements to determine existing noise conditions.

Both industry and commercial activities generate truck and automobile traffic. Thus, they should be located in areas where truck access is possible without having to pass through residential areas.

Truck routes in Ripon--those roads which can expect significant amounts of noisy trucks, and an increase in truck traffic in the future, are delineated on the following map.

3. Recreation Related

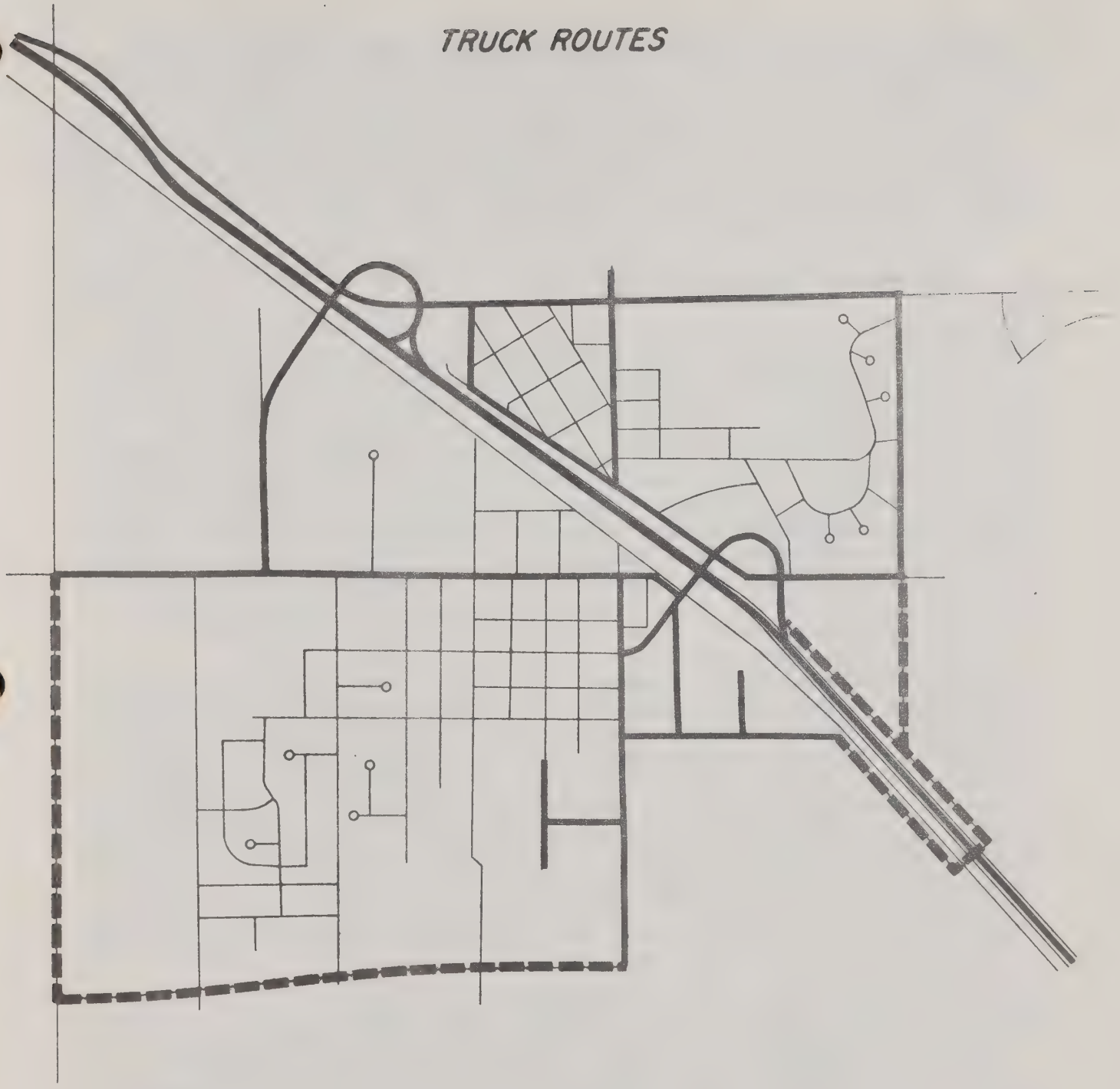
Noise considerations in recreation are important. Areas need to be provided for those wishing to engage in quiet pursuits such as bicycling, hiking, picnicking, and canoeing. Specific areas also need to be designated for those wishing to engage in noisy activities such as motorcycle riding or skeet shooting. Noisy recreational activities can be especially bothersome because, unlike traffic on most roadways and most business operations, the noisiest periods tend to be after work and on weekends when people are at home.

Many noise conflicts have occurred where motorcyclists use open fields or railroad right-of-ways near residences for riding. Yet there is only one designated motorcycle park in San Joaquin County, near Tracy. The City or local motorcycle groups could help the county locate suitable areas for such parks. To alleviate existing motorcycle noise problems (if they are or become a problem) the City could adopt part of the League of California Cities Model Noise Ordinance relating to regulation of off-street vehicular noise.

Two general recreation "noise" tenets follow:

1) Noise levels intruding into recreational areas and structures should not hinder the enjoyment of the recreational activity. Thus, where a recreational area is designed for quiet

TRUCK ROUTES



CITY OF RIPON
No Scale

ACTUAL ROUTES
PROPOSED ROUTES

activities, it should not be placed near major noise sources. Other types of recreation areas, however, may be compatible with such uses.

2) Design of recreation areas, particularly those involving noisy activities, should protect surrounding sensitive land uses from disturbance. Where there are noisy sections of a park, they should be buffered from more sensitive park uses as well as land uses outside the park.

4. "Nuisance" Noise Problems

Nearly half of all persons complaining about vehicular noise in San Joaquin County stated specifically it was cars and motorcycles with modified mufflers, speeding vehicles, or cars with squealing brakes or tires which caused annoyance, not standard cars driven at posted speeds. This is primarily a police problem. For this reason, direction to the Police Department to cite speeders and automobiles with inadequate muffling could do a great deal to reduce annoyance from traffic noise in most residential areas. However, the Police must deal with a number of problems and speeding and noise are often lower in priority. An approach some cities have taken is to use off duty policemen to deal specifically with noise problems. Effective noise control programs, like everything else, cost some money.

Barking dogs are another major nuisance complaint. Yet it may be difficult for those bothered by this nuisance to obtain relief. In Ripon, three persons must sign a written complaint before the animal can be declared a nuisance; however, it may be that only one person is exposed to the barking dog nuisance through unfortunate siting of a bedroom window. Most people do not want to have to ask neighbors to sign a complaint to solve a problem only they may face. And most neighbors, if they are not also severely bothered, do not want to sign.

Many recent noise ordinances have been worded to try to be fair to both parties. A typical wording reads:

> Section _____. Animals and Fowl.
> No person shall keep or maintain, or permit the keeping of, upon any premises owned, occupied or controlled by such person, any animal or fowl otherwise permitted to be kept which, by any sound, cry or behavior, shall cause annoyance or discomfort to a reasonable person of normal sensitiveness in any residential neighborhood.

5. Home Appliance and Equipment Noise

Appliances and home equipment are certainly sources of noise pollution in and around the home. The Environmental Protection Agency in its Report to the President and Congress on Noise

classified types of home appliances and their effects on people. (Refer to chart on page 14.) "Quiet major appliances" (Group I) such as refrigerators or air conditioners, usually have few adverse effects on people. However, they can cause speech and sleep interference. Some window air conditioning units are loud enough to interfere with speech. Also, steady noise appliances which are relatively quiet during the day may become prominent and annoying at night. One researcher found air conditioning noise in a bedroom measuring from 33-38 dB(A) generated some complaints, from 39-47 dB(A) frequent complaints, and above 48 dB(A) continual complaints.

Group II appliances, "Quiet equipment and small appliances," such as washing machines, hair dryers, vacuum cleaners, etc., will cause speech interference while in use. Annoyance may also be great. While the operator may be annoyed by brief speech interference, those subjected to the noise may be equally, if not more annoyed, at interruption of their activities (TV watching, stereo listening, conversation). The annoyance of such people, including neighbors in multi-family residences and family members in other rooms, is conditioned in part by the intrusive nature of the noise and in part by feelings created be the inability to control the noise source.

Group III, "Noisy small appliances" includes such appliances as blenders and garbage disposals. Exposure to noise from this group of appliances is brief and is usually separated by long intervals. These factors mitigate the impact of relatively high level noise produced by these appliances. Hearing damage is a possibility if exposure is long enough, as in the case of a home seamstress. Use of such machines can hasten eventual hearing damage in the context of cumulative exposure from many sources. Severe speech interference for the person operating the machine is another effect of such appliances and often for those in other rooms. As with Group II appliances, annoyance is probably the major effect.

Group IV covers about 4 million electric yard care tools and 12 million electric shop tools used in this country. Hearing damage risk can be great if exposure is habitual or prolonged. Hobbyists using power tools regularly are likely to experience prolonged exposure at working distances of a few feet. Speech will be nearly impossible for the operator and very difficult for those nearby. Annoyance can be great: a neighbor's noise, particularly at levels as high as those of Group IV sources, is rarely welcome.

6. Special Problems

a. Ripon Grammar School: Noise levels from trucks on Main Street are disturbing at times in four classrooms at Ripon Grammar School. This problem is worst during warm weather when doors need to be

opened for air circulation and harvest season is underway, bringing more trucks. The classrooms are only 85 feet off Main Street, thus every time a truck passes by, noise levels will reach about 75 dB(A) at the door and at least 65 dB(A) inside with doors open. Speech (and thus learning) interference at classroom distances begins occurring at 40-45 dB(A) and becomes quite severe above 60 dB(A). It is clear, then, that the situation at this school is not a desirable one. Air conditioning could significantly improve the situation in these classrooms. With doors and windows closed, peak noise levels from outside would be reduced about 10 decibels, or 1/2 as loud.

b. Hospitals, Convalescent homes and rest homes, and elderly housing: The elderly and the ill are particularly susceptible to disturbance by noise as was noted in Section II. Yet in Ripon, a convalescent hospital, and elderly housing front on major roads. To protect against noise disturbance, it would be better to locate such buildings off major roads.

SECTION V.

METHODS FOR NOISE REDUCTION

A. INTRODUCTION

Society has allowed noise to become an environmental problem and has made only sporadic attempts to control it. The existence of noise problems is related to economics, priority settings, attitudes, ignorance of the environmental health effects of noise, and man's ability to try to adapt to certain environmental predicaments. With an understanding of sound and its effects on humans, and knowing the sources of noise, certain changes can be made to reduce the amount of unwanted sound that reaches the ear.

There are several methods of noise control. They include:

- -quieting the noise source itself
- -substituting noisy operations with quieter operations
- -buffering or enclosing the source
- -controlling the operation or location of noisy sources
- -absorbing reflected sound
- -masking the noise
- -insulating the receiver

In most instances, the key to quiet is in the planning, layout, and design of a building, of a subdivision, or of a city. Once construction has occurred, it is usually much more expensive and difficult to achieve satisfactory results. Excellent results can be achieved, often at little to no added expense if noise considerations are taken into account at the beginning of a project.

The remaining portion of this section deals with outline methods of alleviating existing bothersome noise situations, and methods of designing to prevent problem noise situations from occurring in the future.

B. ROAD NOISE ABATEMENT TECHNIQUES, PROCEDURES AND OTHER ALTERNATIVES

1. Vehicle Noise Reduction

It is abundantly clear, from the COG noise survey and results of other published surveys that the din of motor vehicle traffic is more annoying to people than almost all other noises put together. If city living is to be made tolerably quiet, primary efforts must be directed to reducing the noise of motor traffic.

California motor vehicle noise laws have established step-down maximum noise levels which manufacturers must meet to sell all types of vehicles in the State. These have provided an impetus

to manufacturers to reduce noise levels of motor vehicles, and much research is being directed toward better muffling of exhaust, quieter tire designs, and quieter and better enclosures around engines. The Federal Government will be preempting states from setting such noise limits governing the sale of products. However, they have adopted standards identical to present California requirements regarding truck noise levels. No standards for other motor vehicles have as yet been proposed. (California regulations remain in effect until federal standards are adopted.)

a. Trucks: Noise emitted by a truck has several principal components: exhaust, engine, gears, fan and air intake. In addition, at higher speeds, tire and wind noise add to the problem. Thus, reducing truck noise is a complicated problem.

With present technology, most existing trucks can be quieted to 86 dB(A) at 50 feet. Truck manufacturers state there are technical obstacles and there may be as much as a 15% increase in costs to reduce noise levels significantly lower. Certainly, in the near future, these allowable levels are too high to help residents living near truck routes.

Whatever levels are achieved, maintenance must play a large part in maintaining lower truck noise levels. The average diesel truck runs over 500,000 miles in its lifetime. Over this time period, many truck components will be replaced either due to wear or to modification for individual operator needs. Consequently, the noise output of many heavy trucks can increase significantly from their original condition, particularly if muffler and tire replacements do not provide noise performance equal to that of the original equipment. For example, the difference between a faulty or no muffler and a truck muffler in good condition is approximately 15 dB(A).

Tire replacement is also important. Tires fall into three clearly defined categories as noise producers: pocket retread, cross bar, and rib. Loudest are the pocket retread. The quietest tires are rib designs. Loudness produced by most tires increases when the tire is half worn. The difference between rib and pocket retreads may be nearly 20 decibels: 4 times as loud.

Operation of the truck also makes a difference in noise levels. On a level roadway, acceleration produces 5 dB(A) more than steady running conditions.

b. Automobiles: Exterior levels of passenger cars show that the noise of the newest vehicles (manufactured since 1969) is 2 to 3 decibels less than that of older vehicles. According to testimony given at the Senate Noise Hearings, the large majority of passenger cars built in the U.S. since 1969 meet present California noise requirements.

As with trucks, tire types make a great deal of difference in automotive noise levels, particularly at high speeds. All known comprehensive studies of auto traffic noise show that tire noise becomes a dominant source at high speed. Rib tires are quietest.

c. Motorcycles: With motorcycles there is unfortunately often a real tradeoff between power and quiet. This is not so with cars where there are no space problems or weight limits. Mufflers on motorcycles, particularly off-road cycles can cut power. Thus, most motorcycle owners modify the mufflers.

Research is underway to develop demonstration mufflers and new ways to design muffling systems so that motorcycles can be powerful and quiet.

In State tests, motorcycles with modified mufflers gave readings 5 to 8 dB(A) higher than comparable percentages of motorcycles with apparently stock mufflers. Over 75% of the motorcycles in speed zones of 35 mph or less and 25% of those on freeways were observed to have modified exhaust systems. Of those in violation of present limits, the percentages with modified systems were 79% and 81%. More effective mufflers will undoubtedly help alleviate this situation.

While research is underway to reduce noise levels of vehicles, individual owners can help by keeping mufflers in good condition, buying quiet tires, and driving quietly. However, at least in the near future, reduction of noise at the source will not solve the problem. There is still a need for location and design of major roads so that noise impacts are minimized.

2. Location and Design of Major Roads

a. Separation: Ideally, major roads should be separated from sensitive uses by open space, or industry or commerce, assuming these latter two uses do not impact sensitive uses. In route selection, noise impacts should be carefully weighed against other costs and benefits, and noise sensitive areas avoided where possible. Once the route is chose, minimizing noise impacts through road design becomes important. Wider right-of-ways can lessen the worst noise impacts. However, the additional land needed to achieve acceptable noise levels in sensitive areas is great. To achieve acceptable levels, other methods are more important.

b. Barriers: The primary method for significantly reducing noise from major roads is to put up barriers. Good barriers may reduce noise 10 to 15 decibels, which means sounds would sound half or one third as loud as before the barriers went up. Any barrier shielding is limited to a 15 dB(A) reduction because of leakage over the top and environmental factors.

To be effective a barrier must:

1) Be high enough and long enough to block vehicles from view; what can be seen can be heard.
2) Have reasonable mass.
3) Not leak sound through cracks or holes.

Barriers may be constructed of concrete blocks and slabs, bricks, thick 1/2" plywood panels or earth. All will provide about equal amounts of reduction since the leakage over the top of the barrier determines the net result. Solid concrete block or slabs have superior durability. Earth mounds covered with plantings are probably the most pleasing type of barrier and are particularly effective because they can both absorb and block sound. Combinations such as concrete barriers atop earth berms may also be used.

In 1971, the State Department of Public Works estimated 11 foot high barriers would cost between $40 and $50 per lineal foot. Costs for six foot high noise barriers started at $5 per lineal foot for wood fences, and $10 for plain concrete, masonry, or stucco walls. Special esthetic treatments or additional height automatically raises both initial cost and accident repair costs. Often the most economical barrier is a greenery covered earth berm, if space permits.

A 1972 EPA report estimated noise barriers may cost from $50,000 to well over $100,000 per mile depending on type of construction and whether or not they were included in the original highway design. However, barriers are often cheaper or better than other alternatives such as buying very wide easements or right-of-ways, zoning long strip commercial or industrial areas, insulating individual homes, etc.

c. Buildings: Buildings can also act as sound barriers. A solid row of commercial buildings may provide up to 15 decibels reduction. A typical reduction of about 5 dB per row of houses can be used depending on how closely spaced the buildings are.

Sound penetration studies indicate that shielding from structures is effective only for the first two or three rows of houses and remains constant thereafter. The maximum reduction from houses should not exceed a maximum of 10 dB and should only be applied where no direct line-of-sight to the noise source exists.

Where there are only scattered buildings, each individual building might produce a small localized barrier effect, but the combined effect of sparsely located buildings is negligible. It is understood that a one story barrier will not effectively shield the second story of a 2 story building behind it.

d. Plantings: Plantings will not reduce noise levels significantly although they do help provide a psychological feeling of isolation. At most, noise levels might be reduced 1 decibel per four feet of dense plantings. Another report suggests a 5 dB reduction per 100 feet of dense trees not to exceed 10 dB. This is because plantings possess none of the physical properties that are required of a good sound shield. They are pourous to air and sound, vibrate easily and lack density. As wind can pass through them, so can sound.

e. Engineering Designs: Engineering controls, such as depressing or elevating highways can also reduce noise impacts. At a point 100 feet away from the nearest traffic lane, noise levels from a 20 foot elevated roadway will be 3 to 7 decibels less than from ground level roads. Depressed roadways can make an even greater difference. Once shielding from sight of vehicles becomes effective (at about 100 feet from the nearest traffic lane) noise levels will be about 12 decibels less than levels from ground level roads.

Combining barriers with the above designs can make a dramatic contribution to further noise reduction.

3. Road Surfaces, Gradients, Vehicle Speeds, Stoplights and Curves.

Road surfaces can make a possible 7 decibel difference in average noise levels from automobiles. According to "Fundamentals and Abatement of Highway Traffic Noise" the difference is as follows.

Surface Description	Add to Auto Noise Level
Very rough surface	+5 dB(A)
Rough surface	+2 dB(A)
Average surface	0
Medium smooth surface	-2 dB(A)

(Very smooth surfaces could reduce noise levels even further but they would be too slippery to be safe.)

Not only road surface, but road condition adds to noise. If a road is rutted and bumpy, irritating clanks and rattles from all vehicles will stand out. Keeping roads in good repair will reduce the bothersomeness of vehicular noise.

Steep road gradients will increase truck noise levels up to 5 decibels.

Lower vehicle speeds reduce noise levels. Most vehicles increase 2-1/2 to 3 decibels per increase of 10 mph. Keeping speed limits down thus can have a beneficial effect in some marginal situations.

Timing stoplights or straightening very sharp road curves will reduce shift changes and braking, allowing vehicles to pass more smoothly and quickly by.

4. Policing and Route Restrictions.

Other possibilities for alleviating traffic noise are greater policing efforts toward muffler noise enforcement, and for control of speeding and reckless driving.

Truck routes are another way for cities to control vehicular noise. In most cases this means trucks are limited to certain routes; however, cities can also limit truck access to certain times of the day.

5. Zoning and Building Restrictions.

Zoning land adjacent to major roads for non-residential use is a good way to reduce road noise impacts. Where this is not feasible, local governments can place building restrictions on development of sensitive land uses in noise impacted areas. Insulation of homes adjacent to major roads is briefly discussed in the following "Building and Design Techniques" section.

C. RAILROAD NOISE ABATEMENT TECHNIQUES

Methods for reducing train noise have not received attention until very recently, and are limited in effectiveness and few in number. Only a small number of vehicles in operation today have been affected even by existing programs.

1. Vehicle Noise Reduction.

Most diesel electric locomotive exhause systems have no mufflers. Since this is a major cause of noise, it is possible that mufflers could be designed to reduce overall sound levels. In addition, more substantial casing around the diesel engine together with acoustically absorbent material may be effective in reducing noise from this source.

Lubricating wheels will reduce wheel/rail noise slightly, as will use of steel wheels with a constrained damping layer.

Loud train whistles are a particular source of annoyance. The League of California Cities suggests that all train whistle noise levels could be limited to 101 dB(A) at 75 feet from the train and still adequately warn drivers. Train whistles now range from 87 to 111 dB(A) at 75 feet.

2. Track Noise Reduction.

Grinding tracks to eliminate surface irregularities may lower noise levels. Welding tracks will yield a 3 to 6 decibel improvement in average levels over bolted rails.

3. Route Design.

As with roadways, barriers can significantly reduce noise levels from trains, particularly if they are installed close to the track. Many train tracks are slightly elevated, and this must be taken into account in shielding with barriers. However, since most noise (other than engine noise) comes from wheel/rail interaction, barriers which only partially shield the train may achieve significant reductions.

4. Land Use Planning.

Land use planning can play an important role in railroad related noise control. Unlike roadways, there is little need for convenient access to railroads. Thus, separation of sensitive uses for railroads can be employed without diminisheing the railroad's transportation function. This is the most effective tool local governments can utilize to control railroad related noise. Switch-yard areas in particular should be separated and buffered from residential land use.

5. Railroad Operations.

Local governments are largely preempted from regulating railroad operations to reduce noise: for example, by placing limits on speed or curfews on operations. The state and federal Public Utilities Commissions contend they have final authority over all phases of railroad operations. Thus planning for compatible land use, and utilizing building restrictions on nearby developing sensitive land uses are the more important local government tools.

D. RECREATIONAL NOISE ABATEMENT

Maintenance of recreational vehicles in good operating condition is necessary for keeping noise levels down.

1. Vehicle Operations and Policing.

Motorcycles are covered by state noise laws. Police may cite operators for modified mufflers or inadequate muffling and for exceeding maximum vehicle noise limits. Active enforcement of such laws will help bring noise levels of the worst offenders in line.

Curfews on use of recreational vehicles is another possibility.

2. Establishment of Special Use Areas.

Two types of recreational areas need to be provided for and buffered from other uses:

One is the quiet use area where motorized vehicles and other high noise producing sources are restricted or prohibited. These could include separated bicycle paths and "natural use" park areas where access is limited to motor vehicles, and earth berms or other barriers provide a buffer from noisier areas.

The other is the noisy recreational area for motorcycles, skeet shooting, etc., where people can engage in noisy activities without disturbing other persons. Such uses would have to be designed, buffered, and located so that noise impacts on other uses are minimal. Abandoned gravel pits, for example, could be used for motorcycle parks.

E. NOISE CONTROL IN AND FROM INDUSTRIAL AND COMMERCIAL USES

1. Designing for Site Noise Control.

Designing for quiet is almost as important for industrial and commercial uses as it is for residential use. In building or remodeling, many decisions can be made which will affect interior and exterior plant or office noise levels. Lowering interior noise levels alone may have the added benefit of reducing exterior noise emissions.

Isolating and enclosing noisy sources, buying quiet machinery and equipment when possible, using sound absorptive material such as drapes, acoustic tiles, carpets, etc., to reduce reverberation of sound are all methods which will reduce noise.

Engineering Control Methods. Following are several general methods for controlling primarily in-plant industrial noise levels. Some methods will apply to offices and commercial uses also.

- Maintenance of machines in good working condition
- Substituting noisy machines with quieter ones (i.e., larger slower machines for smaller faster ones, or presses instead of hammers)
- Substituting noisier processes with quieter ones (such as welding instead of riveting)
- Vibration dampening (using cushions or increasing mass)
- Reducing sound transmission through solids (with flexible mountings or shaft couplings)
- Reducing sound produced by fluid flow (with intake and exhaust mufflers)
- Isolating the operator (by enclosure)
- Equipment location and environment (utilizing distance and existing barriers to their best advantage)

a. Building Insulation and Barriers: As with other noise sources, insulation of the building and barriers can be utilized to alleviate noise impacts from commercial and industrial uses where they will affect sensitive uses. Barriers can be put up to buffer noise levels. Careful construction, orientation, and insulation of new buildings will help reduce the transmission of "problem" noise levels.

b. Excess Land Acquisition: Excess land can be purchased to use as a buffer zone so that noise created by an industry or commercial activity does not impact other land uses.

c. Location of Access Routes: In the design of industrial and commercial areas, heavy traffic or truck routes should be located so that access to the area does not pass through sensitive land uses. This is an important consideration in the location and design of any use generating significant amounts of traffic, particularly truck traffic. In existing situations where more than one access route is available, elimination of the access which passes through a sensitive use area is a possibility.

d. Buy Quiet: Noise specifications should be requested when buying new equipment so that comparative purchases can be made.

Specifications should: 1) Describe what level is desired in a particular situation, remembering that two or three pieces of the same equipment spaced closely together will yield higher overall sound levels (doubling the source will increase sound levels by 3 dB); 2) Request that manufacturers specify what level they can meet if they cannot meet the desired level; 3) Specify how the equipment should be measured (in dB(A)...) or various other measuring scales may be used; 4) Specify the distance at which levels should be measured: at the operator's distance, and perhaps at greater distances to determine noise effects on the larger work situation or community.

2. Land Use Planning and Performance Standards:

Land use planning for compatible land uses is important around industrial and commercial use areas. Residences need to be protected from noise impacts from commercial and industrial activities, as industrial and commercial uses need to be protected from possible restrictions on activities brought about from citizen actions.

On the peripheries of industrial or commercial use areas, performance standards specifying how much noise may be emitted into sensitive use areas can be employed for new business and industry.

Decibel and/or time limits should be spelled out. No performance standards should allow noise levels which exceed reasonable noise ordinance limits so that problem situations are not created. Since noise ordinances were developed to mitigate existing noise problems in a reasonable manner, performance standards may strive to create even lesser noise impacts on a surrounding area.

3. Site Operations.

Curfews are used as a method for alleviating community noise problems when people are most apt to be disturbed--in the evening and at night. They are the primary method for controlling construction noise.

4. Other Control Methods for Construction Activities.

Some cities have put decibel limits on the amount of noise a construction site may generate. Measures which can be utilized to control construction site noise include:

- Operate only certain equipment at one time
- Move some of the noisiest equipment items further into the construction site
- Use temporary walls or complete enclosures around certain equipment
- Modify the equipment to make less noise through muffling
- Buy quieter replacement equipment, or substitute quieter processes when possible.

5. Noise Ordinances.

Local governments can regulate business and industrial noise emissions through noise ordinances. This tool helps alleviate existing noise conflicts between land uses. In most instances, ordinances set maximum decibel and time limits to noises emitted at the property line a) of the receiving use or b) of the business or industry.

6. Personal Ear Protection.

Ear plugs or muffs will reduce noise levels reaching the inner ear 20 to 30 decibels or more. In a situation where noise is harmful, or distracting, ear protection can be helpful. It is a poor substitute for a quieter environment and should only be utilized when other methods are not available or feasible. There is some risk that a person may not hear important warnings with earplugs in, particularly if a person already has hearing loss. These risks are minimized if the earplugs are properly fitted. And reducing further hearing loss and minimizing distraction are certainly compensating benefits.

F. BUILDING AND DESIGN TECHNIQUES FOR SOUND REDUCTION

This section suggests building design and construction methods to reduce noise levels in structures.

1. Placing and Orientation of Buildings.

The sensitive building should be located as far away from a noisy source as possible. Noise producers should be buffered from sensitive uses. Sensitive buildings should be shielded with a solid barrier which completely blocks the noise-producing source from sight. Holes or cracks in the barrier, or any openings such as streets, side yards, etc., will allow sound to pass through. Complete shielding allows homes to be built much closer to major roads and railroads without adverse noise impacts.

The layout of a building itself may also be oriented so that noise impacts are lessened. For example, in a residence, bedrooms should be located away from the noise source so that other parts of the building can serve as a shield. Garages can be located at the front of the dwelling. Some newer commercial buildings along major arterials are locating doors at the back, away from noise sources to minimize business disruptions when doors are opened.

2. Building Construction Techniques.

Other than buffering through distance or barriers, building construction and design, and sound insulation are the major factors making interior environments acceptable or not near major noise sources.

With proper construction techniques, the full reduction potential of a sensitive use structure can be realized. For residential dwellings, this corresponds to approximately 20 decibels for an ordinary wood frame construction, and 25 decibels for masonry buildings, according to the U.S. Department of Transportation:

Building Type	Window Condition	Noise Reduction due to Exterior of the Structure
All	Open	10 dB
Light Frame	Ordinary Sash Closed	20
	With Storm Windows	25
Masonry	Single Glazed	25
	Double Glazed	35

With extra sound insulation, residences can have acceptable interior living environments where exterior noise levels are high. But costs are fairly high also, and such added sound insulation is more economically feasible in multi-family rather

than single family homes. If demands for housing and a lack of suitable land for development make it necessary to build in noise-impacted areas, proper insulation can insure that at least interior living environments are acceptable.

Sound insulation may be needed not only for reduction for noise from exterior sources, but between units of multi-unit dwellings. Too often, sound insulation is not provided between dwelling units (or office spaces) causing annoyance, disruption of activities such as speech or sleep interference, and a loss of privacy. It is not possible to achieve accurate control of sound transmission by simply specifying construction requirements for walls and floors. This is because noise can travel from one room to another along continuous walls, through cracks, ventilation ducts, pipes, etc., no matter how good the noise reduction properties of the wall itself. Thus, the Uniform Building Code, new State housing insulation standards and COG policies focus on specifying limits for the amount of noise which may be received in units, leaving it to the builders to devise means of complying with these limits. The COG Noise Element identifies sound reduction properties of various types of wall and floor-ceiling assemblies,

Many precautions should be taken by builders so that the full sound reduction potential of any building, insulated or not, is achieved. Types of construction precautions follow:

Noise Control Precautions for Builders:

Doors:

- Stagger doors across hallways
- Avoid sliding doors where control of noise is desired
- Use solid wood core doors or mineral core doors where privacy is demanded. Hollow core doors will lower sound insulation and should never be used when a high performance is desired.
- Seal doors at top and sides with soft type weather stripping and use automatic threshold.

Windows:

- Minimize window sizes facing noisy areas. Solid insulated walls would tend to provide better sound reduction.
- Arrange casement windows so sound is not reflected into adjoining units.
- Movable windows should close tightly and be weather-stripped.

- Thick glass, insulating glass, double glazing and double windows with air space between can all help reduce noise transmission through windows.

Equipment Noise:

- Locate heating and cooling equipment far from bedrooms.
- Inquire about equipment noise levels before buying and insist on quiet units.
- Isolate equipment in room with door to outside or use a solid core door, gasketed, when access is from building interior.
- Mount equipment on fiberglass board or other resilient mountings to isolate vibrations from entering structure.

Ducts, & Conduits:

- Do not pierce common floors or walls with duct system.
- Avoid construction such as ducts, rigid conduits or corridors which act as speaking tubes to transmit sound from one area to another.
- Line ducts with insulation to absorb noise, (treat both supply and return air systems). Conduits should be sealed.
- Ducts, pipes, and conduits should be broken with resilient non-rigid boots or flexible couplings where they leave vibrating equipment.

Plumbing:

- Design pipe runs with swing arm so expansion and contraction can occur without binding and thus eliminate noise.
- Isolate piping from structure with resilient gasketing and caulking where they pass through walls, floors or other building surfaces.
- Develop a well-planned layout to minimize the noise of water flowing. Over-size pipes and reduced pressure will slow the speed of flowing water and reduce noise.
- Provide air chambers at each outlet to eliminate water hammer due to abrupt stop of flowing water.
- Use quiet action water closets and isolate from structure on a floating floor.

Electrical:

- Wire each apartment as a unit - avoid penetration of walls or floors between apartments.
- Caulk holes made by wiring which penetrates connecting structures with plastic caulk or dry packing.
- Connect vibrating equipment with flexible wiring.

Maintaining Full Reduction Potential of Walls and Floor-Ceilings:

- Avoid unnecessary perforating walls or ceilings. Optimum sound isolation requires that holes not be cut for vents or grilles or by recessing cabinets, light fixtures, etc. Instead they should be surface mounted. Where holes are necessary, avoid placing them back to back and immediately next to each other. Electrical boxes should be staggered, at least one stud space.
- Seal all openings in walls and floor-ceilings. A non-hardening, resilient caulking material should be used to seal all cutouts, such as around electrical, telephone and piping outlets. The backs and sides of electrical boxes should also be caulked to prevent sound leaks. Caulking should be used to seal all intersections with the adjoining structure, such as where the wall assembly meets the floor-ceiling.
- All cracks in subfloors should be sealed with an air tight caulk or a layer of underlayment should be installed over the entire surface.
- Close all open spaces between joists over party walls with blocking to prevent sound travel over walls. Under party walls, close open space between joists under floors and install gypsum board or plywood at least 4 feet wide to bottom of joists.
- Cover all party wall and ceiling surfaces behind ducts and piping, behind bathtubs, behind soffits, and under stairs with gypsum board.
- Use resilient floor coverings such as carpeting to isolate structure borne vibrations and sound.
- Select quiet, high quality appliances.
- Use adequately sized water piping and valves to minimize whistling.
- Select quiet air conditioners with balanced fans and quiet motors.

OTHER TIPS ON:

Quieting the Home and Neighborhood

- Use rubber or foam pads under dishwashers, mixers, blenders, to reduce vibration and thus noise levels.
- Add insulation to metal heating ducts, or replace with plastic ducts.
- Use sound absorbing materials (carpets) on floors, especially where there is a lot of traffic.
- Hang heavy drapes over windows closest to outside noise sources.
- Put rubber or plastic treads on uncarpeted stairs.
- Use upholstered (soft fabric) furniture to absorb sound.

- Pourous walls and ceilings (cork, unpainted concrete block, acoustic tiles, textured ceilings) help absorb and deaden sound.
- Wooden cabinets vibrate less than metal ones.
- Install washing machines in the same room with heating and cooling equipment, preferably in an enclosed room.
- Use a hand lawnmower. If a power mower must be used, it should be used at reasonable hours.
- Cracks are excellent conductors of airborne sound. If the noise is from outside, patch any cracks or openings around pipes, heating ducts, windows, doors, etc.
- Buy quiet toys for children. They will bother adults less and are safer for a child. (Some of the new noisy tricycles make it difficult for a child to hear warnings such as a car approaching. Toys making explosive sounds can cause permanent hearing injury.)
- Solid barriers which partially enclose an air conditioner will help reduce sound transmitted across to a neighbor. A roof installation can lower air conditioner sound levels transmitted across property boundaries. (Side yard air conditioner installation is prohibited in many cities.)
- Air conditioner units should be located away from bedrooms.
- Window air conditioners may be placed where they will help mask objectionable noises.
- Use flexible weatherstripping to seal doors and windows tightly.

Choosing a New House or Apartment

- Stay away from major noise sources such as airports, railroads and railroad switchyards, truck routes or heavily travelled roads, industry, etc.
- Look for wall to wall carpeting in rooms and corridors.
- Find out about wall construction (staggered stud walls are among the quietest). Are radios or voices easily heard in the next apartment.
- Ask about door construction. Solid, or core-filled doors with gaskets and weatherstripping are quieter.
- If possible, turn on heating and air conditioning systems. Check the loudness, and the difference between when on and off. If the difference is noticeable, it may disturb sleep. If the heater cannot be turned on, check ducts. Insulation inside or plastic ducting helps make systems quieter.

Choosing Appliances

- Buy quiet. Compare different makes of appliances for noise output before making a selection. The 1972 Federal Noise Control Act will require comparative

labeling of appliances for noise output soon. When it does, compare labels.

- Write manufacturers. Until the demand for quieter products grows many manufacturers may not take necessary steps to design quieter products at reasonable cost.

APPENDIX A

A METHOD FOR PREDICTING PEAK NOISE LEVELS AT SPECIFIC SITES FROM MAJOR ROADS AND RAILROADS

and

CNEL NOISE CONTOUR MAPS

METHOD

PEAK NOISE LEVEL PREDICTION

A. Peak Noise Levels to be Expected at Specific Sites from Major Roads and Railroads: How to Estimate

1. Note whether road or railroad is at grade, 20 feet elevated, or 20 feet depressed.

2. Measure distance from nearest lane of traffic or the rail line to site. For roads estimate speed. Predict peak expected noise levels from peak levels charts.

3. Estimate shielding from buildings and barriers and subtract from predicted peak levels.

4. Road condition and gradient may also be estimated and added or subtracted from predicted peak levels.

B. To Estimate Shielding:

1. From buildings:

- Subtract 3 decibels per row of buildings when buildings occupy 50% of area

- subtract 5 decibels per row of buildings when buildings occupy 60-70% of row area

- subtract 7 decibels per row of buildings where buildings occupy 80% of row area

- subtract 10 decibels where buildings occupy 90% of row area

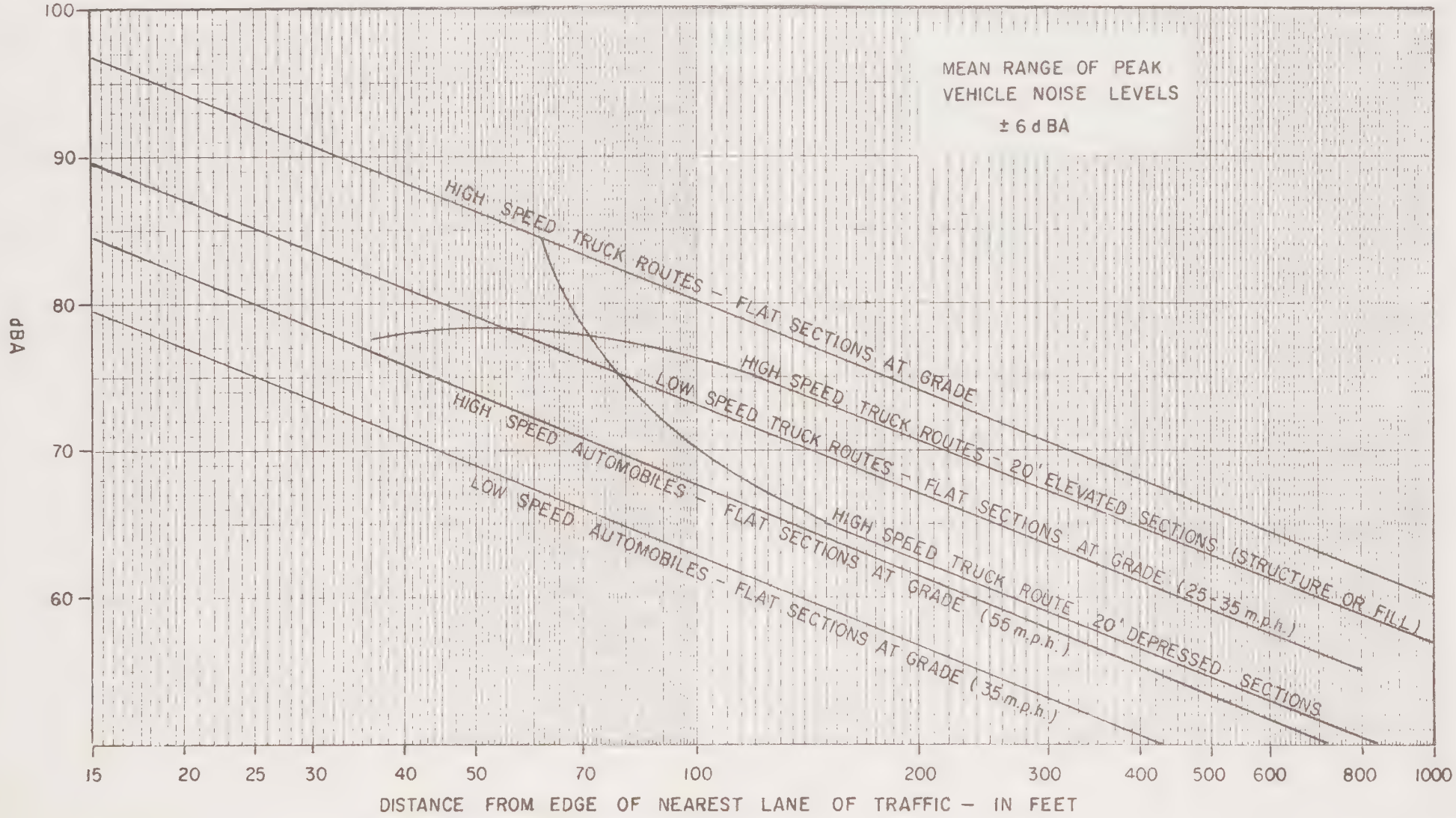
- subtract 10-15 decibels where a solid row of continuous buildings completely blocks vehicles from sight.

Sound penetration studies indicate shielding is effective for the first two to three rows of buildings and remains constant thereafter. Reduction (except for continuous buildings) should not exceed a maximum of 10 decibels. The average height of the barrier row of buildings must be the same or higher than the buildings to be shielded for a noise reduction to be realized. Where roadways are elevated, shielding by buildings is very difficult. No direct line of sight to the roadway should exist. Where only scattered buildings exist,each building might produce a small localized barrier

Figure 2-1

TYPICAL PEAK VEHICLE NOISE LEVELS VERSUS DISTANCE FROM MAJOR ROADS

MICROPHONE 5 FEET ABOVE GROUND

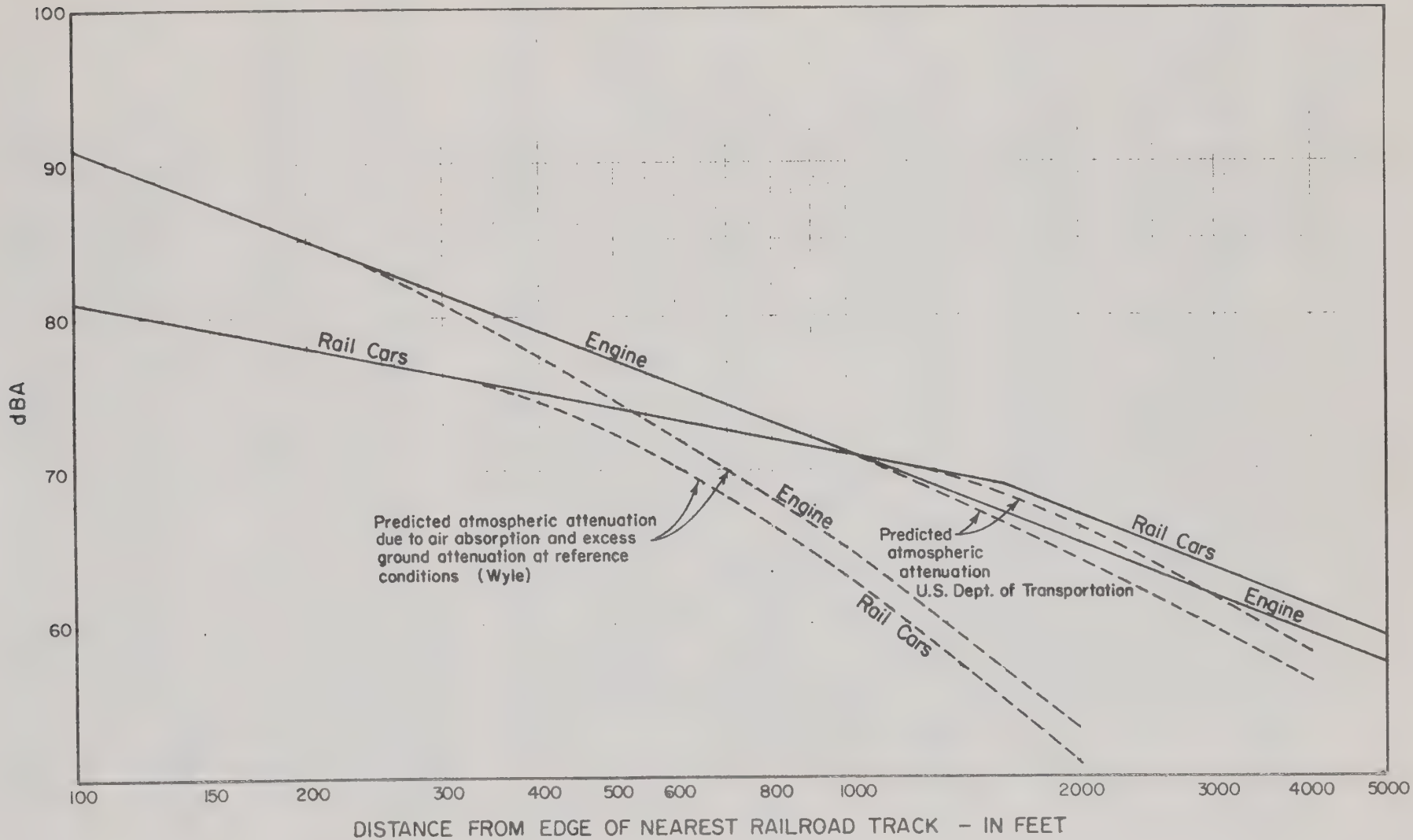


NOTE: FREEWAY RIGHT OF WAY TYPICALLY 36'.

SOURCE: CALIFORNIA DEPARTMENT OF TRANSPORTATION: DIVISION OF HIGHWAYS, NOISE LEVEL INFORMATION.

PEAK NOISE LEVELS VERSUS DISTANCE FROM TYPICAL TRAIN PASSBY AT 35 M.P.H.

MICROPHONE 5 FEET ABOVE GROUND



Source: Assessment of Noise Environments Around Railroad Operations, Wyle Laboratories Report, July 1973.

Notes: The engine is a point noise source, thus sound levels drop 6 dB per doubling of distance. Train cars are a finite line source at close distances. Sound levels drop 3 dB per doubling of distance out to about 3/10 of the length of the train, at which point the train becomes a point source. Sound levels then drop 6 dB per doubling of distance. Southern Pacific trains average 5500 feet.

effect, but the combined effect is negligible.

2. From barriers:

   - subtract 1 decibel per foot of optical screening up the side of a vehicle for the first 6 feet and 1.4 decibels for each foot thereafter where site is only partially shielded from view of vehicles.

   - subtract 10 to 15 decibels where a barrier, earth contour or continuous row of buildings completely blocks vehicles from sight. (A 15 decibel reduction is difficult to achieve and is about the maximum attainable.)

   Barriers should be solid and contain no cracks or holes for sound to leak through. (See page 35). Barriers along elevated or depressed roadways may not need to be as high as those along at grade roadways to shield vehicles from view.

3. From plantings:

   - subtract up to 1 decibel for every four feet of very dense plantings which shield vehicles from view.

   - subtract 5 decibels per 100 feet of mature trees which block sight of vehicles. This should not exceed 10 decibels at a maximum.

   Plantings will usually have very little effect on noise levels, although they may provide a psychological feeling of isolation.

C. Road Condition

- subtract 2 decibels for a smoother than average surface.

- add 2 decibels for a medium rough road surface.

- add 5 decibels for a very rough road surface, i.e., grooved concrete or rough asphalt, or roads with many bumps, cracks, or pot holes.

D. Gradient

- add 2 decibels where grade is 3-4 percent

- add 3 decibels where grade is 5-6 percent

- add 5 decibels where grade is 7 percent or more.

E. Atmospheric Conditions

There are atmospheric effects which would seldom increase but could significantly decrease sound levels at large distances from a source. These decreases are usually of an intermittent, short term duration and they are usually beneficial to the receiver (in giving a temporary noise reduction). It is best not to rely on them for long-term benefits in terms of noise control. However, because some amount of wind and thermal gradients are almost always present, the Federal Department of Transportation suggests a small additional reduction due to atmospheric conditions of 1 decibel per thousand feet starting after the first 1000 feet for motor vehicle noise. They believe no additional attenuation due to atmospheric conditions is necessary for the first 1000 feet. This would seem to apply to train noise also since, like truck noise, it is predominantly a low frequency sound which does not attenuate as rapidly as higher frequency sounds.

Wyle Laboratories, the major source dealing with Railroad noise, did include atmospheric attenuation effects in their charts because it fit the base data they collected. Using a reference condition of 60 degrees with 50% humidity, they found an additional 6 decibel sound reduction at 1000 feet for train engine noise and 8 decibels for rail car noise. This is shown in the peak train noise levels chart. For year round weather conditions, however, a more conservative approach seems desirable. The Department of Housing and Urban Development uses 3000 feet as the cutoff distance between "clearly acceptable" areas and discretionary areas where there is some noise impact. This corresponds closely with a 60 decibel peak level contour at 3000 to 3400 feet (using DOT's predicted atmospheric attenuation factors) within which the Council of Governments suggests noise impacts be considered.

A few generalizations regarding atmospheric attenuation can be made. Over the long term, effects are not great at distances less than 1000 feet. At far distances, high frequency sounds attenuate more rapidly than low frequency sounds. Thus, the scream of a jet at close range becomes a low roar at a distance. Also, temperature inversions tend to increase sound at far distances.

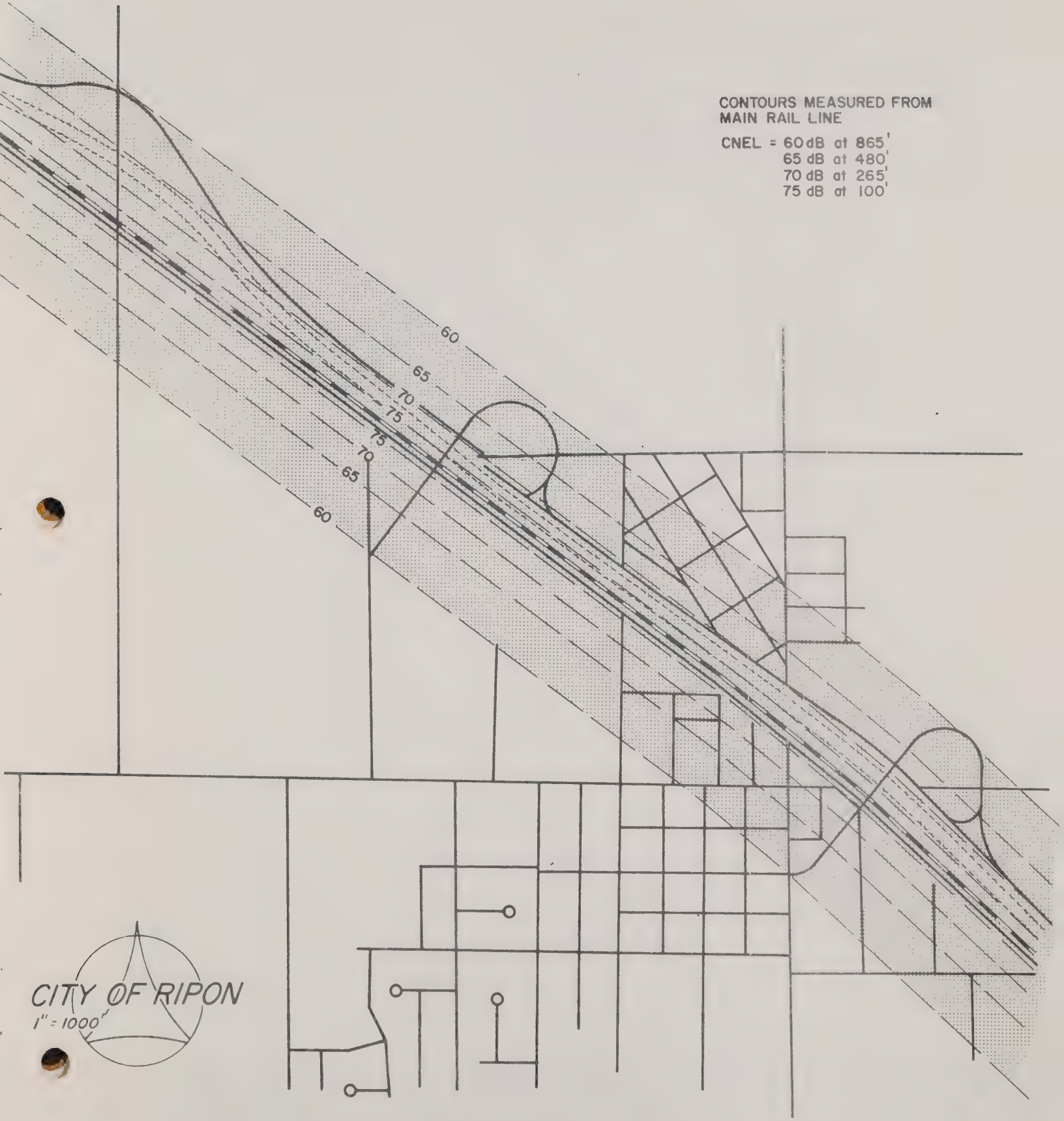
On the following pages CNEL noise contours required by State law are shown. These noise contours are not the same as peak level noise contours which were just described. The peak level method shows what noise levels can actually be expected at a site a certain distance from a road or railroad.

The CNEL contours show noise levels measured in dB(A) which have been averaged over a 24 hour period with added weight given to

noise events occurring at night. They identify relative areas of noise impacts. New State housing legislation states that any new residential development except single family homes falling within a CNEL = 60 dB must have an acoustical analysis done showing that the structure has been designed to limit intruding noise to prescribed allowable levels.

The peak level and CNEL methods are both acceptable for use in the noise element.

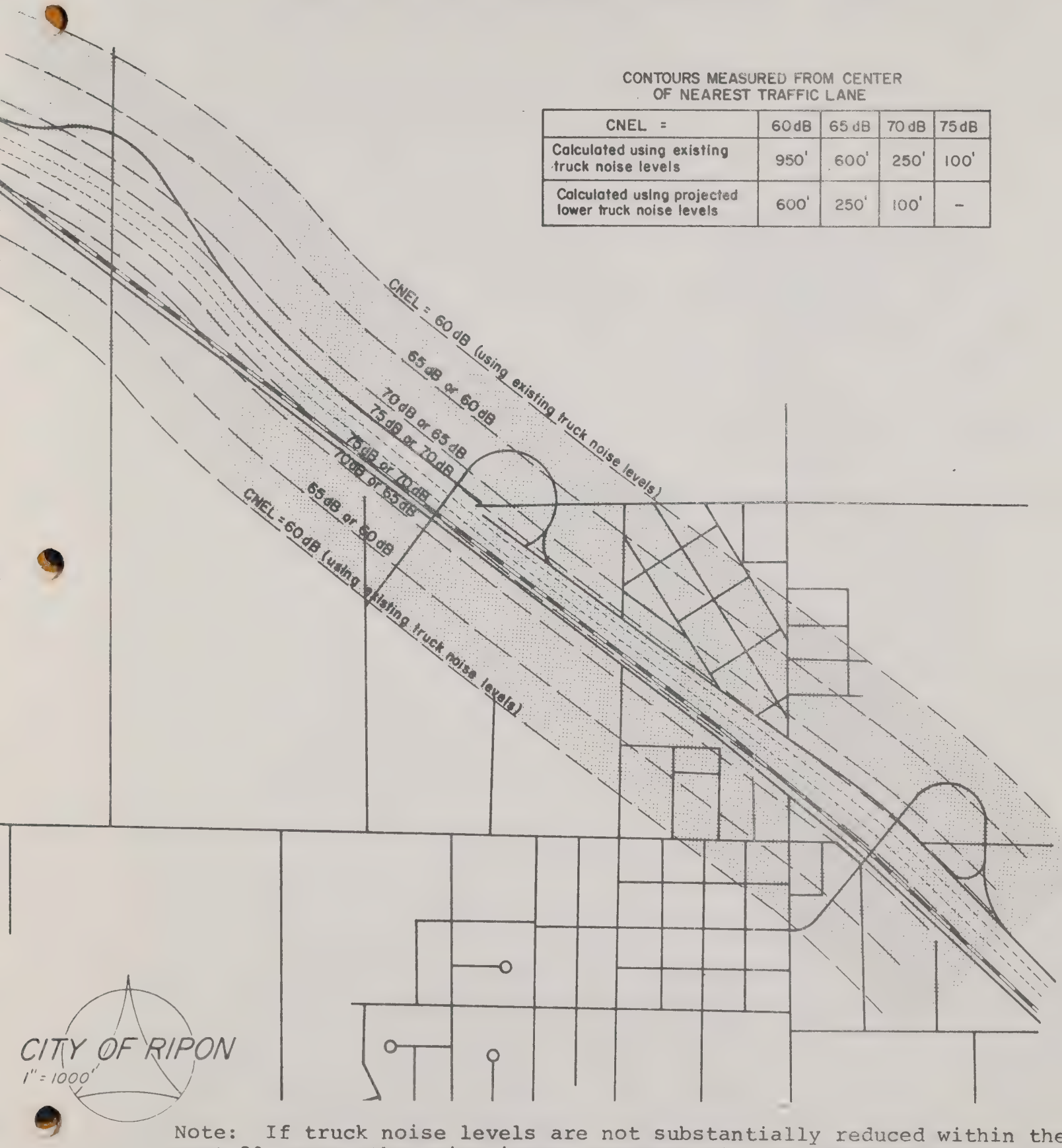
CNEL RAILROAD NOISE CONTOURS



PROJECTED CNEL FREEWAY NOISE CONTOURS - 1995

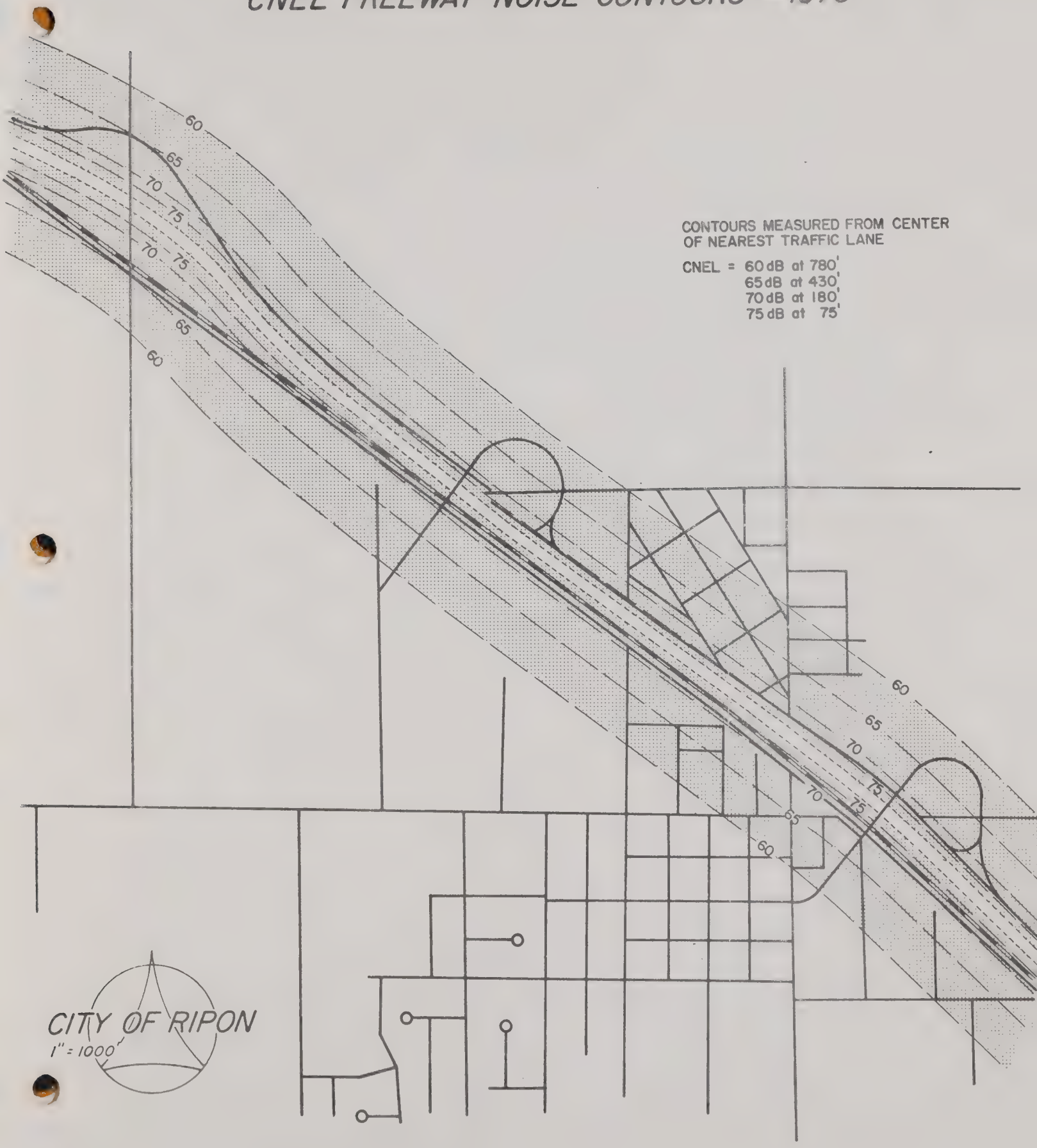
CONTOURS MEASURED FROM CENTER OF NEAREST TRAFFIC LANE

CNEL =	60dB	65dB	70dB	75dB
Calculated using existing truck noise levels	950'	600'	250'	100'
Calculated using projected lower truck noise levels	600'	250'	100'	–



Note: If truck noise levels are not substantially reduced within the next 20 years, the noise impact contours will be larger than the 1973 contours. If trucks are quieted, the noise impact contours will be smaller than 1973 contours despite increases in traffic volume.

CNEL FREEWAY NOISE CONTOURS - 1973



APPENDIX B

LEAGUE OF CALIFORNIA CITIES
MODEL NOISE ORDINANCE AND PERTINENT LEGISLATION

Model Noise Ordinance-League of California Cities

ORDINANCE NO. ____

AN ORDINANCE OF THE CITY OF _____ ADDING CHAPTER _____ TO TITLE _____ OF THE _____ MUNICIPAL CODE PROHIBITING EMISSION OR CREATION OF NOISE BEYOND CERTAIN LEVELS.

THE CITY COUNCIL OF THE CITY OF _____ DOES ORDAIN AS FOLLOWS:

Chapter ____ consisting of six articles and entitled "Noise Regulation" is added to the _____ Municipal Code to read as follows:

CHAPTER _____. NOISE REGULATION

Article 1. General Provisions

Section _____. Declaration of Policy.

It is hereby declared to be the policy of the City to prohibit unnecessary, excessive, and annoying noises from all sources subject to its police power. At certain levels noises are detrimental to the health and welfare of the citizenry and in the public interests shall be systematically proscribed.

Section _____. Definitions.(1)

As used in this chapter, unless the context otherwise clearly indicates, the words and phrases used in this chapter are defined as follows:

(a) Ambient Noise. "Ambient noise" is the all-encompassing noise associated with a given environment, being usually a composite of sounds from many sources near and far. For the purpose of this ordinance, ambient noise level is the level obtained when the noise level is averaged over a period of 15 minutes without inclusion of noise from isolated identifiable sources, at the location and time of day near that at which a comparison is to be made.

(b) Decibel. "Decibel" shall mean a unit of level when the base of the logarithm is the tenth root of ten and the quantities concerned are proportional to power.

(c) Emergency Work. "Emergency work" shall mean work made necessary to restore property to a safe condition following a public calamity or work required to protect persons or property from an imminent exposure to danger or work by private or public utilities when restoring utility service.

(d) Frequency. "Frequency" of a function periodic in time shall mean the reciprocal of the primitive period. The unit is the hertz and shall be specified.

(e) Hertz. "Hertz" shall mean the complete sequence of values of a periodic quantity which occurs during a period.
(f) Microbar. "Microbar" shall mean a unit of pressure commonly used in acoustics and is equal to one (1) dyne per square centimeter.
(g) Period. "Period" of a periodic quantity shall mean the smallest increment of time for which the function repeats itself.
(h) Periodic Quantity. "Periodic quantity" shall mean oscillating quantity, the values of which recur for equal increments of time.
(i) Person. "Person" shall mean a person, firm, association, copartnership, joint venture, corporation, or any entity, public or private in nature. (2)
(j) Sound Level. "Sound level" (noise level), in decibels (dB) is the sound measured with the A weighting and slow response by a sound level meter.
(k) Sound Level Meter. "Sound level meter" shall mean an instrument including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement of sound levels which satisfies the pertinent requirements in American Standard Specifications for sound level meters S1.4-1971 or the most recent revision thereof.
(l) Motor Vehicles. "Motor vehicles" shall include, but not be limited to, mini-bikes and go-carts.
(m) Sound Amplifying Equipment. "Sound amplifying equipment" shall mean any machine or device for the amplification of the human voice, music, or any other sound. "Sound amplifying equipment" shall not include standard automobile radios when used and heard only by the occupants of the vehicle in which the automobile radio is installed. "Sound amplifying equipment", as used in this chapter, shall not include warning devices on authorized emergency vehicles or horns or other warning devices on any vehicle used only for traffic safety purposes.
(n) Sound Truck. "Sound truck" shall mean any motor vehicle, or any other vehicle regardless of motive power, whether in motion or stationary, having mounted thereon, or attached thereto, any sound amplifying equipment.
(o) Commercial Purpose. "Commercial purpose" shall mean and include the use, operation, or maintenance of any sound amplifying equipment for the purpose of advertising any business, or any goods, or any services, or for the purpose of attracting the attention of the public to, or advertising for, or soliciting patronage or customers to or for any performance, show, entertainment, exhibition, or event, or for the purpose of demonstrating such sound equipment.
(p) Noncommercial Purpose. "Noncommercial purpose" shall mean the use, operation, or maintenance of any sound equipment for other than a "commercial purpose." "Noncommercial purpose" shall mean and include, but shall not be limited to, philanthropic, political, patriotic, and charitable purposes.

Section _____. Sound Level Measurement Criteria.

Any sound level measurement made pursuant to the provisions of this chapter shall be measured with a sound level meter using the "A" weighting.

Section _____. Ambient Base Noise Level.

Where the ambient noise level is less than designated in this section the respective noise level in this section shall govern.

		Sound Level A, decibels		
		Community Environment Classification		
Zone	Time	Very Quiet (rural,suburban)	Quiet (suburban)	Slightly noisy (suburban,urban)
R1 and R2	10 pm to 7 am	40	45	50
"	7 pm to 10 pm	45	50	55
"	7 am to 7 pm	50	55	60
R3 and R4	10 pm to 7 am	45	50	55
"	7 am to 10 pm	50	55	60
Commercial	10 pm to 7 am	55	60	
"	7 am to 10 pm	60	65	
M1	anytime	70	70	
M2	anytime	75	75	(3)

Section _____. Violations: Misdemeanors.

Any person violating any of the provisions of this chapter shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be fined in an amount not exceeding(4) Five Hundred and no/100ths Dollars ($500.00) or be imprisoned in the City or County Jail for a period not exceeding six (6) months, or by both such fine and imprisonment. Each day such violation is committed or permitted to continue shall constitute a separate offense and shall be punishable as such.

Section _____. Violations: Additional Remedies: Injunctions

As an additional remedy, the operation or maintenance of any device, instrument, vehicle, or machinery in violation of any provision of this chapter, which operation or maintenance cause discomfort or annoyance to reasonable persons of normal sensitiveness or which endangers the comfort, repose, health, or peace of residents in the area, shall be deemed and is declared to be, a public nuisance and may be subject to abatement summarily by a restraining order or injunction issued by a court of competent jurisdiction.

Section _____. Severability.

If any provision, clause, sentence, or paragraph of this chapter or the application thereof to any person or circumstances, shall be held invalid, such invalidity shall not effect the other provisions or applications of the provisions of this chapter which can be given effect without the invalid provisions or application and, to this end, the provisions of this chapter are hereby declared to be severable.

Article 2. Special Noise Sources

Section _____. Radios, Television Sets, and Similar Devices.

(a) Use restricted. It shall be unlawful for any person within any residential zone of the City to use or operate any radio receiving set, musical instrument, phonograph, television set, or other machine or device for the producing or reproducing of sound (between the hours of 10:00 p.m. of one day and 7:00 a.m. of the following day)(5) in such a manner as to disturb the peace, quiet, and comfort of neighboring residents or any reasonable person of normal sensitiveness residing in the area. (6)

(b) Prima facie violation.(7) Any noise level exceeding the ambient base level at the property line of any property (or, if a condominium or apartment house, within any adjoining apartment) by more than five (5) decibels(8) shall be deemed to be prima facie evidence of a violation of the provisions of this section.

Section _____. Hawkers and Peddlers.

It shall be unlawful for any person within the City to sell anything by outcry within any area of the City zoned for residential uses. The provisions of this section shall not be construed to prohibit the selling by outcry of merchandise, food, and beverages at licensed sporting events, parades, fairs, circuses, and other similar licensed public entertainment events.

Section _____. Drums.

(a) Use restricted. It shall be unlawful for any person to use any drum or other instrument or device of any kind for the purpose of attracting attention by the creation of noise within the City. This section shall not apply to any person who is a participant in a school band or duly licensed parade or who has been otherwise duly authorized to engage in such conduct.

Section _____. Schools, Hospitals and Churches.

It shall be unlawful for any person to create any noise on any street, sidewalk, or public place adjacent to any school, institution of learning, or church while the same is in use or adjacent to any hospital, which noise unreasonably interferes with the workings of such institution or which disturbs or unduly annoys patients in the hospital, provided conspicuous signs are displayed in such streets, sidewalk or public place indicating the presence of a school, church, or hospital.(9)

Section _____. Animals and Fowl.

No person shall keep or maintain, or permit the keeping of, upon any premises owned, occupied, or controlled by such person any animal or fowl otherwise permitted to be kept which, by any sound, cry, or behavior, shall cause annoyance or discomfort to a reasonable person of normal sensitiveness in any residential neighborhood.

Section _____. Machinery, Equipment, Fans, and Air Conditioning.

It shall be unlawful for any person to operate any machinery, equipment, pump, fan, air conditioning apparatus, or similar mechanical device in any manner so as to create any noise which would cause the noise level at the property line of any property to exceed the ambient base noise level by more than five (5) decibels. (10)

Article 3. Construction.

Section _____. Construction of Buildings and Projects.

It shall be unlawful for any person within a residential zone, or within a radius of 500 feet therefrom, to operate equipment or perform any outside construction or repair work on buildings, structures, or projects or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist, or any other construction type device (between the hours of ____ p.m. of one day and ____ a.m. of the next day)(11) in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance unless beforehand a permit therefor has been duly obtained from (the officer or body of the City having the function to issue permits of this kind). No permit shall be required to perform emergency work as defined in Article 1 of this chapter.

Article 4. Vehicles.

Section _____. Vehicle Repairs.

It shall be unlawful for any person within any residential area of the City to repair, rebuild, or test any motor vehicle (between the hours of ____ p.m. of one day and ____ a.m. of the next day) in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance.

Section _____. Motor Driven Vehicles.

It shall be unlawful for any person to operate any motor driven vehicle within the City in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance; provided, however, any such vehicle which is operated upon any public highway, street, or right-of-way shall be excluded from the provisions of this section. (12)

Article 5. Amplified Sound.(13)

Section _____. Purpose.

The Council enacts this legislation for the sole purpose of securing and promoting the public health, comfort, safety, and welfare of its citizenry. While recognizing that the use of sound amplifying equipment is protected by the constitutional rights of freedom of speech and assembly, the Council nevertheless feels obligated to reasonably regulate the use of sound amplifying equipment in order to protect the correlative constitutional rights of the citizens of this community to privacy and freedom from public nuisance of loud and unnecessary noise.

Section _____. Registration: Required.

It shall be unlawful for any person, other than personnel of law enforcement or governmental agencies, to install, use, or operate within the City a loudspeaker or sound amplifying equipment in a fixed or movable position or mounted upon any sound truck for the purposes of giving instructions, directions, talks, addresses, lectures, or transmitting music to any persons or assemblages of persons in or upon any street, alley, sidewalk, park, place, or public property without first filing a registration statement and obtaining approval thereof as set forth in this Article.

Section _____. Registration: Requirements and Duties.

(a) Registration statements: Filing. Every user of sound amplifying equipment shall file a registration statement with the (officer or department) _____ ( ) days (14) prior to the date on which the sound amplifying equipment is intended to be used, which statement shall contain the following information:

(1) The name, address and telephone number of both the owner and user of the sound amplifying equipment;

(2) The maximum sound producing power of the sound amplifying equipment which shall include the wattage to be used, the volume in decibels of sound which will be produced, and the approximate distance for which sound will be audible from the sound amplifying equipment;

(3) The license and motor number if a sound truck is to be used;

(4) A general description of the sound amplifying equipment which is to be used; and

(5) Whether the sound amplifying equipment will be used for commercial or noncommercial purposes.(15)

(b) Registration Statements: Approval. (Office or department approving registration statement) shall return to the applicant an approved certified copy of the registration statement unless he finds that:

(1) The conditions of the motor vehicle movement are such that in the opinion of _____, use of the equipment would constitute a detriment to traffic safety; or

(2) The conditions of pedestrian movement are such that use of the equipment would constitute a detriment to traffic safety;(16) or

(3) The registration statement required reveals that the applicant would violate the provisions set forth in Section ____ of this Article or any other provisions of this Code.

(c) Disapproval. In the event the registration statement is disapproved, the _____ shall endorse upon the statement his reasons for disapproval and return it forthwith to applicant.

Section _____. Appeals.

Any person aggrieved by disapproval of a registration statement may appeal by complying with the provisions of Section _____ of this Code relating to appeals.

Section _____. Fees.

Prior to the issuance of the registration statement, a fee in the amount of $_____ per day, or any portion thereof, shall be paid to the City, if the loudspeaker or sound amplifying equipment is to be used for commercial purposes.(17) No fee shall be required for the operation of a loudspeaker or sound amplifying equipment for noncommercial purposes.

Section _____. Regulations.

The commercial and noncommercial use of sound amplifying equipment shall be subject to the following regulations:

(a) The only sounds permitted shall be either music or human speech, or both.

(b) The operation of sound amplifying equipment shall only occur between the hours of ____ a.m. and ____ p.m. each day except on Sundays and legal holidays. No operation of sound amplifying equipment for commercial purposes shall be permitted on Sundays or legal holidays. The operation of sound amplifying equipment for non-commercial purposes on Sundays and legal holidays shall only occur between the hours of ____ a.m. and ____ p.m.

(c) Sound level emanating from sound amplifying equipment shall not exceed (15) decibels above the ambient base noise level. (18)

(d) Notwithstanding the provisions of subsection (c) of this section, sound amplifying equipment shall not be operated within 200 feet of churches, schools, hospitals, or City or County buildings.

(e) In any event, the volume of sound shall be so controlled that it will not be unreasonably loud, raucous, jarring, disturbing, or a nuisance to reasonable persons of normal sensitiveness within the area of audibility.

(OPTIONAL PROVISION)

Article _____. Train Horns and Whistles(19)

Section _____. Excessive Sound Prohibited.

It shall be unlawful for any person to operate or sound, or cause to be operated or sounded, (between the hours of 10:00 p.m. of one day and 7:00 a.m. of the next day)(20) a train horn or train whistle which creates a noise level in excess of eighty-nine (89) decibels at any place or point 300 feet or more distant from the source of such sound.

Article 6. General Noise Regulations

Notwithstanding any other provision of this chapter, and in addition thereto, it shall be unlawful for any person to wilfully make

or continue, or cause to be made or continued, any loud, unnecessary, or unusual noise which disturbs the peace or quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitiveness residing in the area.(21)

The standards which shall be considered in determining whether a violation of the provisions of this section exists shall include, but not be limited to, the following:

(a) The level of the noise;
(b) The intensity of the noise;
(c) Whether the nature of the noise is usual or unusual;
(d) Whether the origin of the noise is natural or unnatural;
(e) The level and intensity of the background noise, if any;
(f) The proximity of the noise to residential sleeping facilities;
(g) The nature and zoning of the area within which the noise emanates;
(h) The density of the inhabitation of the area within which the noise emanates:
(i) The time of the day or night the noise occurs;
(j) The duration of the noise;
(k) Whether the noise is recurrent, intermittent, or constant; and
(l) Whether the noise is produced by a commercial or non-commercial activity.

• (Note: No noise from isolated identifiable sources (other than on-street traffic and railroad) shall be above background levels more than 5 decibels (Article 2(b)) with corrections for duration and type of noise. The following corrections are generally added to the measured sound level before comparing to the ambient:

(a) Add one and only one of the following corrections for time duration:

1. Noise persists for more than five (5) minutes out of any one hour.	0
2. Noise persists for more than one minute but not more than five (5) minutes out of any one hour.	-5
3. Noise persists for one minute or less out of any one hour	-10

(b) Add one and only one of the following corrections for unusual character:

1. Noise has no unusual character.	0
2. Noise contains a piercing pure tone.	+5
3. Noise is impulsive or rattling in nature.	+5
4. Noise carries speech, music, or other information content.	+5

Source: League of Calif. Cities Community Noise Control Training Guide and Enforcement Manual.)

FOOTNOTES

(1) Inclusion of these definitions depends upon adoption of pertinent provisions of this ordinance.

(2) Compare with the general definition of "person", if defined in your code.

(3) The sound level limits set for each community should be based in part on the existing ambient noise and the noise environment which the community desires. In rural environments, the night time ambient will be as low as 25 dB(A). In many suburban areas of Los Angeles away from freeways and airports, the day time ambient is between 40 and 45 dB(A). For residential areas (R1 and R2) it is recommended that the night time noise level limits be set not less than 35 dB(A) nor higher than 50 dB(A). As a guide for those communities that do not wish to conduct a noise survey upon which to base their noise level limits, three categories of quietness for residential areas and two categories of noisiness for commercial areas are provided. From the table, select the category which most nearly describes the acoustical environment existing or desired in your city. For example, a very quiet community would choose the left hand column. In some cities where several degrees of quietness exist among both residential and commercial zones, the various categories should be used to develop a consistently graded set of noise zones.

(4) or "punishable as set forth in Chapter ____ of this Code."

(5) If deemed desirable, different hours may be specified or none at all.

(6) The phrase "any reasonable person of normal sensitiveness" was used to come within the case of Fendley vs. City of Anaheim 110 Cal App. 731. That case held that such language was not indefinite or vague.

(7) Mr. Sam Gorlick, City Attorney of Burbank, researched the question of whether an ordinance could create a "prima facie violation." The research developed in his office indicated that this type of evidence rule could be enacted in order to effectively enforce the provision involved. Cited in this opinion were the cases of Commonwealth vs. Kroger, 276 Kentucky 20; 122 SW 2d 1006; and People vs. Kayne, 286 Michigan 571; 282 NW 248. The opinion concluded that "if a municipal corporation establishes a reasonable criteria for a prima facie violation of an ordinance in an apparent valid exercise of its police power, it would be presumed to be valid."

(8) A more strict standard could be three (3) decibels. A lesser amount, however, is not recommended.

(9) This section was prepared by Mr. Robert Austin, Deputy City Attorney of the City of Long Beach.

(10) The Committee is particularly indebted to Mr. Max Strauss, Building and Planning Director of the City of Beverly Hills and for the assistance given to him by Mr. Randy Hurlburt, Acoustical Engineer of the City of Inglewood in the preparation of this section. The original draft of the proposed ordinance contained fixed noise limits for varying sources and it was at the suggestion of Mr. Strauss that the orientation be changed to provide for a relative type of violation i.e., a violation contingent upon the amount of noise created over the ambient base level. As may be seen from the definition section,

"ambient noise" is the all-encompassing noise associated with a given environment and hence, any noise source which generates a noise five decibels or more above that ambient level will be a violation. This relative approach was developed by Mr. Strauss over a decade of enforcement of noise regulations in the City of Beverly Hills using sound measuring equipment. Every community in the state varies to a certain extent insofar as the ambient noise level is concerned and this proposed regulation would seem to fit equally in all communities since it is the difference from the customary noise level that is called to the city's attention for enforcement. Mr. Hurlburt and Mr. Strauss have agreed that five decibels is quantitatively of such a magnitude as to be significant for enforcement purposes.

(11) Times of violation have not been indicated in these proposed regulations since communities may vary considerably with respect to the matter. Likewise, a procedure for the issuance of permits may vary considerably within the various cities. Reference could be made to existing permit procedure as well as to the officer or body having the function to issue permits of this kind.

(12) There is a possibility that this section may be preempted by Secs. 23130 and 27160 of the Vehicle Code.

(13) Mr. Allen Grimes, assisted by Colin Lennard of his office, drafted this section.

(14) Must, under due process requirement, provide a reasonable time.

(15) Although the draft of this ordinance has made a distinction between commercial and noncommercial sound amplifying equipment, allowing the use of both of them in the city subject to regulation, a city may lawfully totally prohibit the use of any sound amplifying equipment to be used for commercial purposes within the city.

(16) Must be supported by substantial evidence.

(17) This section should be included only if your code contains a general appeals provision. The amount should not exceed the cost of administration of the permit system.

(18) Mr. Max Strauss and Mr. Randy Hurlburt have determined that 15 decibels above the ambient base level would constitute a reasonable restriction. In the event a city does not wish to adopt a decibel standard for measuring sound from sound amplifying equipment, it might adopt this alternate section as follows: "The volume of sound shall be so controlled that it will not be audible for a distance in excess of two hundred feet (200') from the amplifying equipment."

(19) Mr. Stanley Remelmeyer, City Attorney of Torrance, performed the original work on this section. His report indicated that there is no PUC order extant on this subject and no statute or case law precluding the city from enacting a regulation of this kind. He expressed the feeling, however, that municipal regulation of this subject would undoubtedly trigger a PUC regulation. This is particularly so if cities enact varying types of regulation. Since the regulation of railroads is to a large extent vested in the PUC and ICC, it should be emphatically mentioned that in the event this proposed regulation is enacted, that the language and provisions be kept uniform throughout the state so that the railroad companies could not assert that there must be PUC regulations to achieve uniformity of regulation. Consultants

have recommended to the Committee 89 dB (A) as a level which should not be exceeded at any place or point measured 300 feet from the train engine. Their studies indicated that the present horn noise at 300 feet is 99 dB(A); the average automobile attenuation with windows rolled up is 22 dB(A). Based upon this datum, the train horn noise could be reduced 10 dB and with a moderately operating radio, still provide sufficient noise level to warn a driver. The average train horn in operation on a diesel locomotive produces a substantial overwarning effect and at night, in some residential communities, provides noise levels, according to these studies, of intolerable levels sometimes as high as 110 decibels. Since every crossing has visual signaling devices, as well as bells, and some have crossing arms, the use of a train horn producing the levels of noise they are capable of, would seem to invite municipal regulation. Many communities, however, do not have a railroad operation and hence, this provision is suggested as being optional.

(20) Include, if time limitation is desired.

(21) The Committee is indebted to Mr. Allen Grimes, City Attorney of Beverly Hills for his brief on the question of whether a local agency can enact a general noise regulation in view of the doctrine of preemption and considering Penal Code Section 415 and other state statutes relating to noise nuisances. Mr. Grimes' brief supports the affirmative and this was supported in a case which he prosecuted in the municipal court entitled People vs. Katleman. The judge in that case carefully reviewed the law and found that the City of Beverly Hills was not preempted from enacting a local noise regulation; that the ordinance was not in conflict with Article XI, Section 11 of the Constitution and that the ordinance itself was not vague and uncertain nor did it violate the right of freedom of speech and due process. The Beverly Hills ordinance provides for general standards in seeking compliance with the ordinance. The court opinion in question commented favorably on these standards as evidence of the fact that the ordinance itself was not vague and unreasonable. The court went on to say that "it is necessary to give consideration to the impracticability of rigid legislative criteria. No more than a reasonable degree of certainty can be demanded." The Committee adopted these same standards in the proposed general noise regulation in order to set the local ordinance apart from Penal Code Section 415 and to remove as much vagueness as possible from the type of regulation involved. The general regulation may be used for every noise source for which there is no specific section in the ordinance or, in the alternative, it may be used in lieu of a section if, for some reason, that section cannot be used as a basis for a complaint.

§ 23130. Noise Limits

(a) No person shall operate either a motor vehicle or combination of vehicles of a type subject to registration at any time or under any condition of grade, load, acceleration or deceleration in such a manner as to exceed the following noise limit for the category of motor vehicle within the speed limits specified in this section:

	Speed limit of 35 mph or less	Speed limit of more than 35 mph
(1) Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle:		
(A) Before January 1, 1973	88 dbA	90 dbA
(B) On and after January 1, 1973	86 dbA	90 dbA
(2) Any motorcycle other than a motor-driven cycle	82 dbA	86 dbA
(3) Any other motor vehicle and any combination of vehicles towed by such motor vehicle	76 dbA	82 dbA

(b) The noise limits established by this section shall be based on a distance of 50 feet from the center of the lane of travel within the speed limit specified in this section. The Department of the California Highway Patrol may provide for measuring at distances closer than 50 feet from the center of the lane of travel. In such a case, the measuring devices shall be so calibrated as to provide for measurements equivalent to the noise limit established by this section measured at 50 feet.

(c) The department shall adopt regulations establishing the test procedures and instrumentation to be utilized. These procedures shall allow, to the extent feasible, noise measurement and enforcement action to be accomplished in reasonably confined areas such as residential areas of urban cities.

(d) This section applies to the total noise from a vehicle or combination of vehicles and shall not be construed as limiting or precluding the enforcement of any other provisions of this code relating to motor vehicle exhaust noise.

(e) For the purpose of this section, a motortruck, truck tractor, or bus that is not equipped with an identification plate or marking bearing the manufacturer's name and manufacturer's gross vehicle weight rating shall be considered as having a manufacturer's gross vehicle weight rating of 6,000 pounds or more if the unladen weight is more than 5,000 pounds.

(f) No person shall have a cause of action relating to the provisions of this section against a manufacturer of a vehicle or a component part thereof on a theory based upon breach of express or implied warranty unless it is alleged and proved that such manufacturer did not comply with noise limit standards of the Vehicle Code applicable to manufacturers and in effect at the time such vehicle or component part was first sold for purposes other than resale.

§ 23130.5. Vehicular Noise Limits: 35 m.p.h. or Less Speed Zone

(a) Notwithstanding the provisions of subdivision (a) of Section 23130, the noise limits, within a speed zone of 35 miles per hour or less on level streets, or streets with a grade not exceeding plus or minus 1 percent, for the following categories of motor vehicles, or combinations of vehicles, which are subject to registration, shall be:

(1) Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle ..... 82 dbA

(2) Any motorcycle other than a motor-driven cycle..... 77 dbA

(3) Any other motor vehicle and any combination of vehicles towed by such motor vehicle ..... 74 dbA

No person shall operate such a motor vehicle or combination of vehicles in such a manner as to exceed the noise limits specified in this section.

The provisions of subdivisions (c), (d), (e), and (f) of Section 23130 shall apply to this section.

(b) Measurements shall not be made within 200 feet of any intersection controlled by an official traffic control device, or within 200 feet of the beginning or end of any grade in excess of plus or minus 1 percent. Measurements shall be made when it is reasonable to assume that the vehicle flow is at a constant rate of speed, and measurement shall not be made under congested traffic conditions which require noticeable acceleration or deceleration.

(c) Test procedures and instrumentation to be utilized shall be in accordance with regulations of the Department of the California Highway Patrol, except that measurement shall not be conducted within 200 feet of any intersection controlled by an official traffic control device, or within 200 feet of the beginning or end of a grade.

(d) The noise limits established by this section shall be based on a distance of 50 feet from the center of the lane of travel within the speed limit specified in this section. The Department of the California Highway Patrol may provide for measuring at distances closer than 50 feet from the center of the lane of travel. In such a case, the measuring devices shall be so calibrated as to provide for measurements equivalent to the noise limit established by this section measured at 50 feet.

Vehicles equipped with at least two snowtread tires are exempt from this section.

The provisions of this section shall become operative on January 1, 1972.

§ 27160. Motor Vehicle Noise Limits

(a) No person shall sell or offer for sale a new motor vehicle which produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the centerline of travel under test procedures established by the department:

(1) Any motorcycle manufactured before 1970..... 92 dbA

(2) Any motorcycle, other than a motor-driven cycle, manufactured after 1969, and before 1973 ..... 88 dbA

(3) Any motorcycle, other than a motor-driven cycle, manufactured after 1972, and before 1975 ..... 86 dbA

(4) Any motorcycle, other than a motor-driven cycle, manufactured after 1974, and before 1978 ..... 80 dbA

(5) Any motorcycle, other than a motor-driven cycle, manufactured after 1977, and before 1988 ..... 75 dbA

(6) Any motorcycle, other than a motor-driven cycle, manufactured after 1987 ..... 70 dbA

(7) Any snowmobile manufactured after 1972 ..... 82 dbA

(8) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1967, and before 1973..... 88 dbA

(9) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1972, and before 1975..... 86 dbA

(10) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1974, and before 1978..... 83 dbA

(11) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1977, and before 1988..... 80 dbA

(12) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1987... 70 dbA

(13) Any other motor vehicle manufactured after 1967, and before 1973..... 86 dbA

(14) Any other motor vehicle manufactured after 1972, and before 1975..... 84 dbA

(15) Any other motor vehicle manufactured after 1974, and before 1978..... 80 dbA

(16) Any other motor vehicle manufactured after 1977, and before 1988..... 75 dbA

(17) Any other motor vehicle manufactured after 1987... 70 dbA

(b) Test procedures for compliance with this section shall be established by the department, taking into consideration the test procedures of the Society of Automotive Engineers.

27150(a) CVC
Every motor vehicle subject to registration shall at all times be equipped with an adequate muffler in constant operation and properly maintained to prevent any excessive or unusual noise, and no muffler or exhaust system shall be equipped with a cutout, bypass, or similar device.

(b) Subdivision (a) shall also apply to motorcycles operated off the highways, except motorcycles being operated in an organized racing or competitive event conducted on a closed course. For the purposes of this subdivision, "closed course" means a permanent motor racing facility which has one or more of the following:

(1) Safety crash walls.
(2) Grandstands which seat 500 persons or more.
(3) Sanitation facilities for persons attending events.
(4) A business license or permit from a local authority to conduct motor racing or competition events.

(c) Every passenger vehicle operated off the highways shall at all times be equipped with an adequate muffler in constant operation and properly maintained to prevent any excessive or unusual noise, and no muffler or exhaust system shall be equipped with a cutout, bypass, or similar device. This subdivision shall not be applicable to passenger vehicles being operated off the highways in an organized racing or competitive event conducted under the auspices of a recognized sanctioning body or by permit issued by the local governmental authority having jurisdiction.

California Administrative Code, Title 25
Chapter 1, Subchapter 1

Adopt a new Article 4 and a new Section 1092 to read:

Article 4. Noise Insulation Standards

1092. Noise Insulation Standards.

(a) Purpose. The purpose of this article is to establish uniform minimum noise insulation performance standards to protect persons within new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings from the effects of excessive noise, including but not limited to hearing loss or impairment and persistent interference with speech and sleep.

(b) Application and Scope. The provisions of this article relating to noise insulation performance standards apply to new hotels, motels, apartment houses and dwellings other than detached single-family dwellings.

These regulations shall apply to all applications for building permits made subsequent to the effective date of these regulations.

These regulations shall be effective 6 months after the adoption by the Commission of Housing and Community Development.

(c) Definitions. The following special definitions shall apply to this article as applicable:

(1) Impact Insulation Class (IIC) - A single number rating for ceiling-floor construction that represents the ability of the construction to isolate impact noise, where measurement procedure is based on ASTM E492-73T and as defined in UBC Standard No. 35-2.

(2) Sound Transmission Class (STC) - A single figure rating for floor-ceiling and interior wall partition construction that represents the ability of the construction to isolate airborne noise, where measurement procedure is based on ASTM E90-70 or ASTM E366-71 and as defined in UBC Standard No. 35-1.

(3) Detached Single-Family Dwelling - Any single-family dwelling which is separated from adjacent property lines by 3 feet or more or is separated from adjacent buildings by 6 feet or more.

(d) Sound Transmission Control Between Dwelling Units.

(1) Wall and Floor-Ceiling Assemblies. Wall and floor-ceiling assemblies separating dwelling units or guest rooms from each other and from public space such as interior corridors and service areas shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

(2) Airborne Sound Insulation. All such separating walls and floor-ceiling assemblies shall provide an airborne sound insulation equal to that required to meet a Sound Transmission Class (STC) of 50 (45 if field tested) as defined in UBC Standard No. 35-1.

Penetrations or openings in construction assemblies for piping, electrical devices, recessed cabinets, bathtubs, soffits, or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings.

Dwelling unit entrance doors from interior corridors together with their perimeter seals shall have a Sound Transmission Class (STC) rating of not less than 30 and such perimeter seals shall be maintained in good operating condition.

(3) Impact Sound Insulation. All separating floor-ceiling assemblies between separate units or guest rooms shall provide impact sound insulation equal to that required to meet an Impact Insulation Class (IIC) of 50 (45 if field tested) as defined in UBC Standard No. 35-2. Floor coverings may be included in the assembly to obtain the required rating and must be retained as a permanent part of the assembly and may only be replaced by other floor covering that provides the same sound insulation required above.

(4) Tested Assemblies. Field or laboratory tested wall or floor-ceiling designs having an STC or IIC of 50 or more as determined by UBC Standard 35-1, 35-2 or 35-3 may be used without any additional field testing when in the opinion of the Building Officials the laboratory tested design has not been compromised by flanking paths. Tests may be required by the Building Official when evidence of compromised separations is noted.

(5) Field Testing. Field testing, when required, shall be done under the supervision of a person experienced in the field of acoustical testing and engineering, who shall forward test results to the Building Official showing that the minimum sound insulation requirements stated above have been met.

(6) Airborne Sound Insulation Field Tests. When required, airborne sound insulation shall be determined according to the applicable Field Airborne Sound Transmission Loss Test procedures of U.B.C. Standard No. 35-3. All sound transmitted from the source room to the receiving room shall be considered to be transmitted through the test partition.

(7) Impact Sound Insulation Field Test. When required, impact sound insulation shall be determined in accordance with U.B.C. Standard No. 35-2.

Note: Excerpts from the 1973 U.B.C., Appendix Chapter 35, reproduced with permission of International Conference of Building Officials, 5360 S. Workman Mill Road, Whittier, California.

(e) Noise Insulation from Exterior Sources.

(1) Location and Orientation. Consistent with land use standards, residential structures located in noise critical areas, such as proximity to select system of county roads and city streets (as specified in 186.4 of the State of California Streets and Highways Code), railroads, rapid transit lines, airports, or industrial areas shall be designed to prevent the intrusion of exterior noises beyond prescribed levels with all exterior doors and windows in the closed position. Proper design shall include, but shall not be limited to, orientation of the residential structure, set-backs, shielding, and sound insulation of the building itself.

(2) Interior Noise Levels. Interior community noise equivalent levels (CNEL) with windows closed, attributable to exterior sources shall not exceed an annual CNEL of 45 dB in any habitable room.

(3) Airport Noise Source. Residential structures to be located within an annual CNEL contour (as defined in Title 4, Subchapter 6, California Administrative Code) of 60 require an acoustical analysis showing that the structure has been designed to limit intruding noise to the prescribed allowable levels. CNEL's shall be as determined by the local jurisdiction in accordance with its local general plan.

(4) Vehicular and Industrial Noise Sources. Residential buildings or structures to be located within exterior community noise equivalent level contours of 60 dB of an existing or adopted freeway, expressway, major street, thoroughfare, railroad or rapid-transit line shall require an acoustical analysis showing that the proposed building has been designed to limit intruding noise to the allowable interior noise levels prescribed in Section 1092(e)(2).

Exception: Railroads, where there are no nighttime (10:00 p.m. to 7:00 a.m.) railway operations and where daytime (7:00 a.m. to 10:00 p.m.) railway operations do not exceed four (4) per day.

(f) Compliance.

(1) Evidence of compliance shall consist of submittal of an acoustical analysis report, prepared under the supervision of a person experienced in the field of acoustical engineering, with the application for building permit. The report shall show topographical relationship of noise sources and dwelling site, identification

APPENDIX C

Partial Listing of Noise Consultants & Home Building Insulation Contractors

- Bolt Beranek & Newman
  1 Jackson Place
  San Francisco 415-391-7610

- Buono Ccorsi & Associates
  215 Market Street
  San Francisco, 94105

- Louis Bourget
  3996 McKinley
  Sacramento 916-456-7478

- Kenward Oliphant
  657 Howard Street
  San Francisco, 94105,415-420-1164

- Fitzroy & Dobbs
  77 Mark Drive
  San Raphael 415-472-3866

- Vincent Salmon
  765 Hobart Street
  Menlo Park 94025 415-323-1777

- Wilson Ihrig & Assoc.
  5605 Ocean View
  Oakland, 94619 415-658-8386

- Sacramento Insulation
  1722 E. Flora
  Stockton 466-8991

- John Turner
  Weathermaster Insulation Co.
  1342 N. Emerald Ave.
  Modesto 522-2476

- American Insulation Co.
  341 Eye Street
  Modesto 527-1280

- Acoustical Thermal Contractors, Inc.
  1336 Lone Palm Ave.
  Modesto 527-0730

APPENDIX D

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